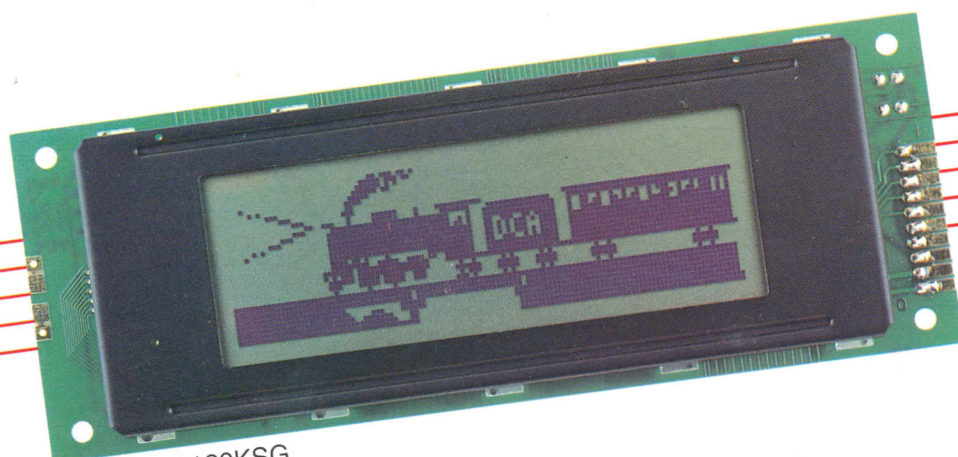


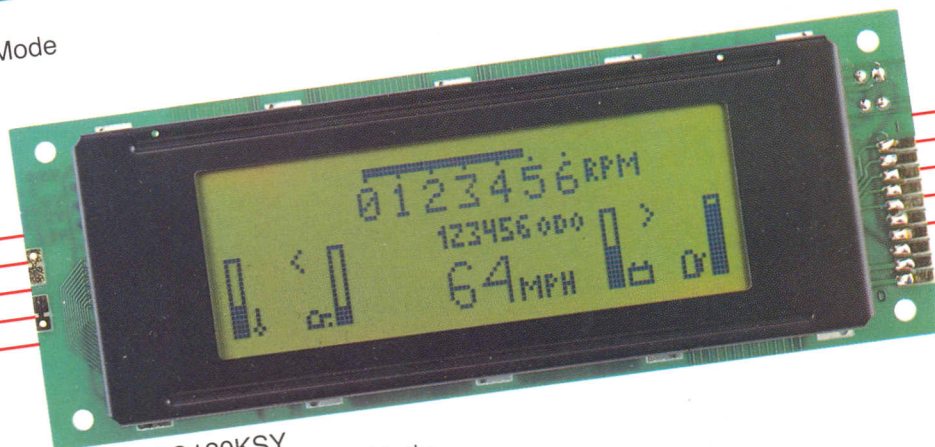
SUPERTWIST GRAPHIC LCD MODULES

InTELaTECH inc.

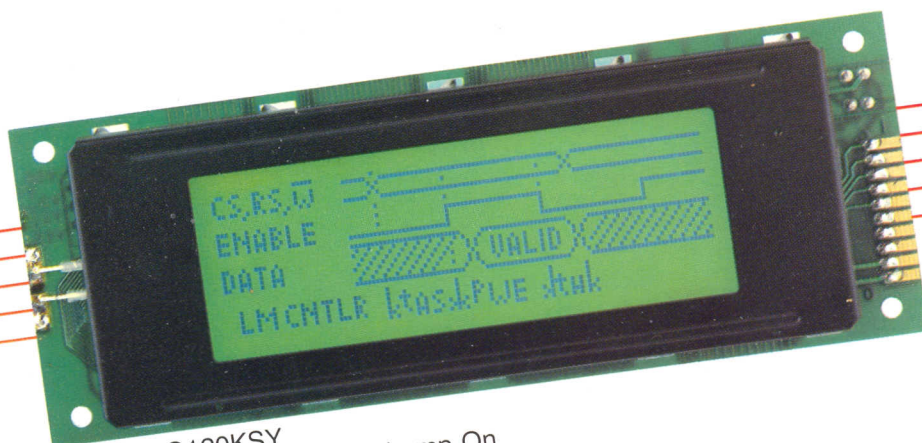
1115 Crestlawn Drive, Suite 1
Mississauga, Ontario L4W 1A7
Tel: (416) 629-0082 Fax: (416) 629-1795



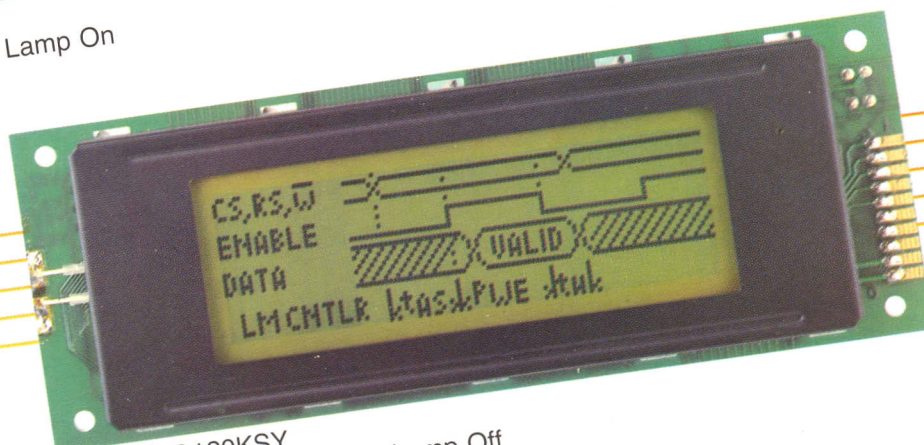
LM51A32G120KSG
Reflective Positive Gray Mode



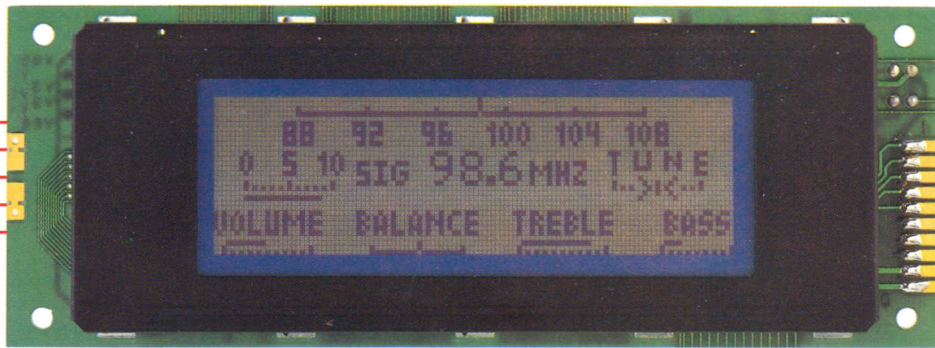
LM51A32G120KSY
Reflective Positive Yellow Mode



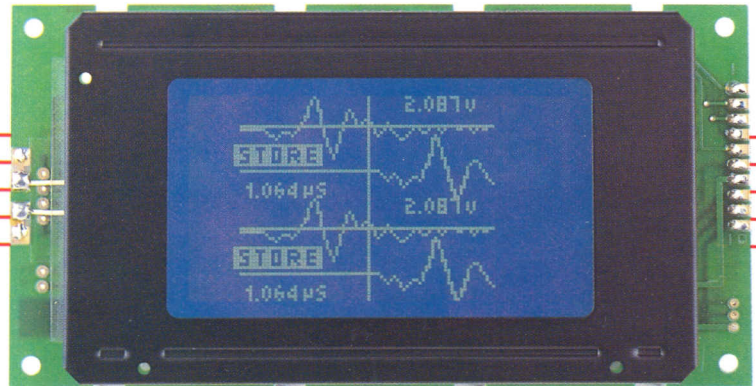
LM51F32G120KSY
Transmissive Positive w/EL Lamp On



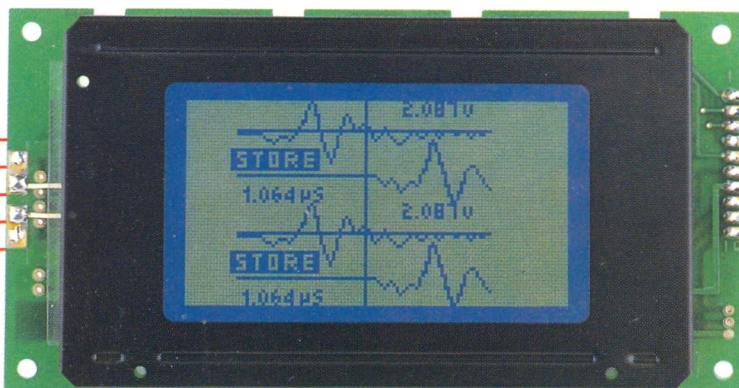
LM51F32G120KSY
Transmissive Positive w/EL Lamp Off



LM51G32G120KSB
Reflective Negative w/Inverted Data



LM53E64G120KSB
Transmissive Negative



LM53E64G120KSB
Transmissive Negative w/Inverted Data



LM858E400G640DSW
"White-Mode"

INTRODUCTION

Densitron is a world-wide technical sales and marketing company bringing advanced, high quality electronic products to leading edge OEMs. Our engineering support enables our customers to efficiently integrate the latest in high technology products into their designs.

Since our inception in 1970, we have been actively involved in displays used for operator/machine interface. This catalog features Supertwist graphic liquid crystal display modules and support electronics.

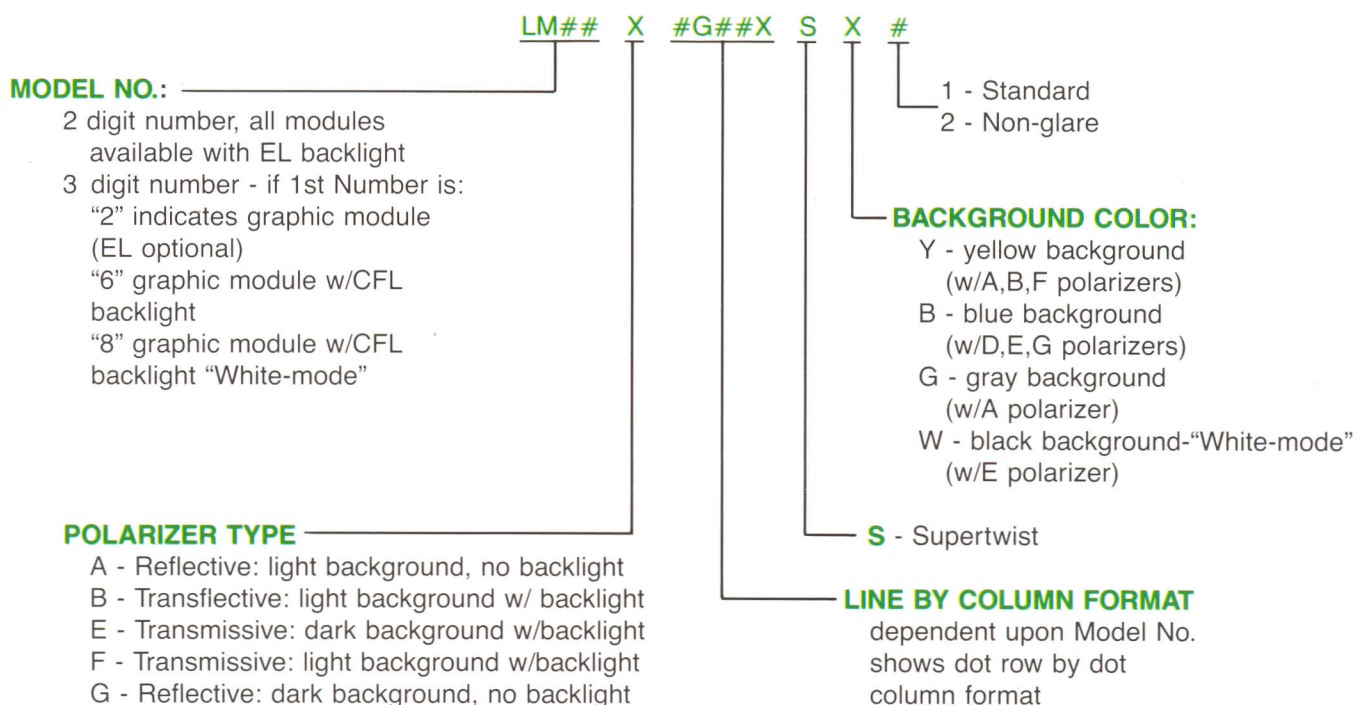
SUPERTWIST GRAPHIC MODULE FEATURES

- Supertwist fluid for high contrast and wide viewing angle.
- Contrast ratio - 7:1 typ.; 15:1 typ. for "White-mode"
- Wide variety of sizes and formats
- Positive and negative viewing modes and background color options
- "White-mode" black-on-white format (limited sizes)
- Controller cards to support microprocessor and systems interface
- Choice of electroluminescent or cold cathode fluorescent backlighting
- DC input inverters for backlight operation
- Non-glare coating option
- High operating temperature (non-Supertwist) fluid available (limited models)
- Value-added capability-modules tailored for production assembly
- Custom capability

ORDERING INFORMATION

Densitron features a "build-a-part-number" system to identify its liquid crystal display modules. Obtain the Model No. based upon the desired format and size. Polarizer type

determines overall look and viewability in various ambient lighting conditions. An explanation of the part number breakdown is given below:



DC DENSITRON CORPORATION

TABLE OF CONTENTS

GRAPHIC MODULES

Dot Format	Model No.	Character Format	Overall Dimensions	Viewing Area	Dot Size	Duty Cycle	Power Supply	Page
32 × 120	LM51	4 × 20	152 × 56 × 15	90 × 32	.65 × .75	1/32	+5/-5	2
64 × 120	LM53	8 × 20	124 × 64 × 15	70.5 × 39.5	.48 × .48	1/32	+5/-5	4
64 × 240	LM54	8 × 40	180 × 75 × 15	132 × 39	.48 × .48	1/32	+5/-5	6
	LM83	8 × 40	180 × 75 × 15	132 × 39	.48 × .48	1/64	+5/-10	8
64 × 480	LM95	8 × 80	290 × 73 × 12	246 × 38	.45 × .45	1/64	+5/-12	10
128 × 256	LM56	16 × 40	200 × 110 × 12	128 × 66.5	.43 × .43	1/64	+5/-12	12
	LM656	16 × 40	211 × 110 × 15	128 × 66.5	.43 × .43	1/64	+5/-12	14
128 × 480	LM57	16 × 80	290 × 110 × 12	237 × 67	.43 × .43	1/64	+5/-12	16
200 × 320	LM650	25 × 40	166 × 110 × 16	125 × 79	.33 × .33	1/200	+5/-20	18
200 × 640	LM89	25 × 80	270 × 130 × 12	247 × 95	.34 × .40	1/100	+5/-12	20
	LM91	25 × 80	265 × 200 × 12	215 × 160	.28 × .73	1/100	+5/-15	22
	LM205	25 × 80	270 × 110 × 12	240 × 79	.33 × .33	1/200	+5/-20	24
	LM240	25 × 80	270 × 210 × 12	215 × 163	.29 × .74	1/200	+5/-22	26
	LM645	25 × 80	281 × 110 × 15	240 × 79	.33 × .33	1/200	+5/-23	28
	LM678	25 × 80	281 × 210 × 16	215 × 163	.29 × .74	1/200	+5/-22	30
	LM879	25 × 80	281 × 210 × 18	215 × 163	.29 × .74	1/200	+5/-22	32
400 × 640	LM213	50 × 80	270 × 210 × 14.5	236 × 172	.33 × .386	1/200	+5/-22	34
	LM218	50 × 80	254 × 170 × 13	201 × 127	.27 × .27	1/200	+5/-22	36
	LM638	50 × 80	265 × 170 × 15	201 × 127	.27 × .27	1/200	+5/-22	38
	LM643	50 × 80	281 × 210 × 16	236 × 172	.33 × .386	1/200	+5/-22	40
	LM858	50 × 80	263 × 170 × 18	201 × 127	.27 × .27	1/200	+5/-23	42
	LM853	50 × 80	281 × 210 × 18	236 × 172	.33 × .386	1/200	+5/-23	44
480 × 640	LM237	60 × 80	260 × 204 × 12.5	220 × 166	.30 × .30	1/240	+5/-22	46
	LM674	60 × 80	271 × 204 × 16	220 × 166	.30 × .30	1/240	+5/+35	48
	LM875	60 × 80	271 × 204 × 18	220 × 166	.30 × .30	1/240	+5/+35	50

All dimensions are in millimeters.

GRAPHIC CONTROLLER CARDS

Models LM1001GC/LM1002GC (For Models LM51, LM53, LM54, LM83, LM95, LM56, and LM656)	52
Model LM1006GC (For Model LM57)	54
Model LM1012GC-X (For Models LM205, LM240, LM645, LM678, LM879, LM213, LM218, LM638, LM643, LM858 and LM853)	55
Series PCX10 (For Models LM89, LM91, LM205, LM240, LM645, LM678, LM879, LM213, LM218, LM638, LM643, LM858, LM853 and LM237)	56
Series SPX20 (For Models LM213, LM218, LM638, LM643, LM858, LM853)	57

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DAS24F06	63

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MODEL LM51X32G120KSX

32 Line × 120 Column

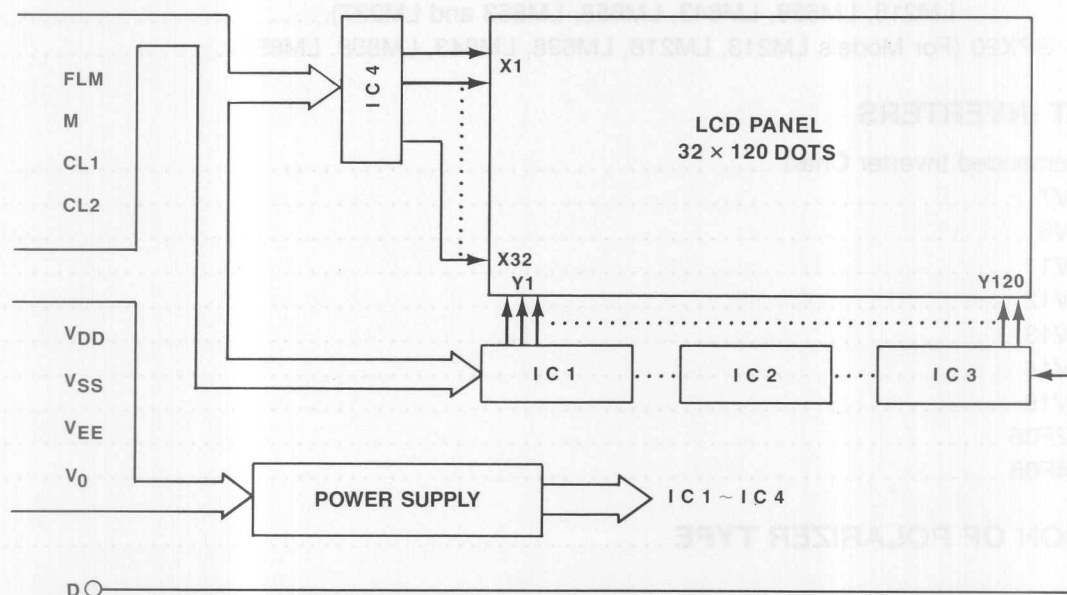
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-4.75	-5.0	-5.25	V
Current Consumption	I _{DD}	f _{CL2} = 277KHz D = GND	—	1.6	—	mA
	I _{EE}		—	1.2	—	mA
Clock Frequency	f _{CL2}	—	270	277	310	KHz
LC Drive Voltage (1/32 duty cycle)	V _{DD} - V ₀	Temp = 0°C	—	9.0	—	V
		Temp = 25°C	—	8.3	—	V
		Temp = 40°C	—	7.6	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	16.0	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

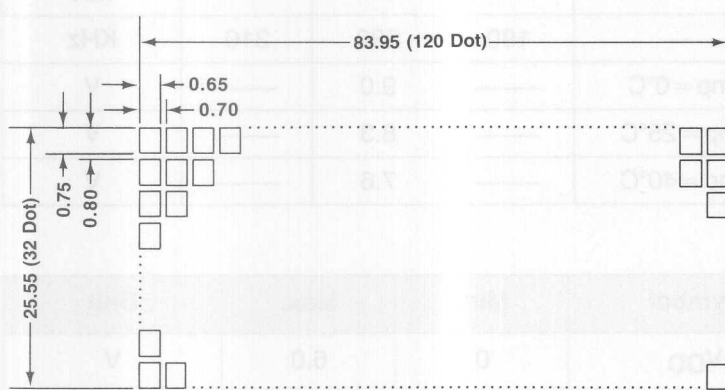


CONNECTOR ASSIGNMENT

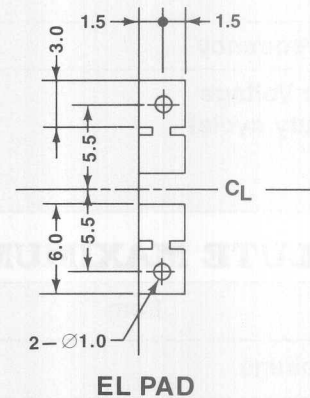
Pin No.	Symbol	Function
1	D	Display data H...Dot on, L...Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

Pin No.	Symbol	Function
6	NC	—
7	VDD	Power supply for logic circuit
8	VSS	Ground
9	VEE	Power supply for LC drivers
10	V ₀	Operating voltage for LC drivers

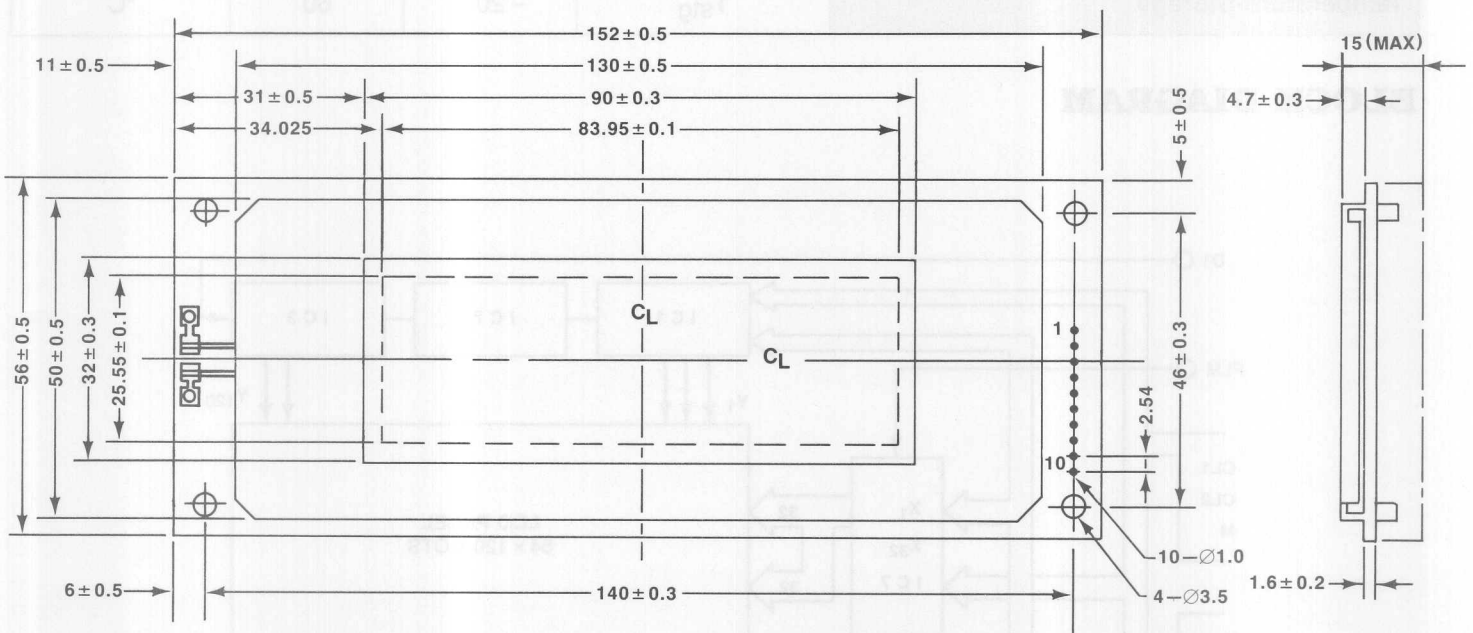
DISPLAY PATTERN



BACKLIGHT CONNECTION



DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1001GC

DC DENSITRON
CORPORATION

MODEL LM53X64G120KSX

64 Line × 120 Column

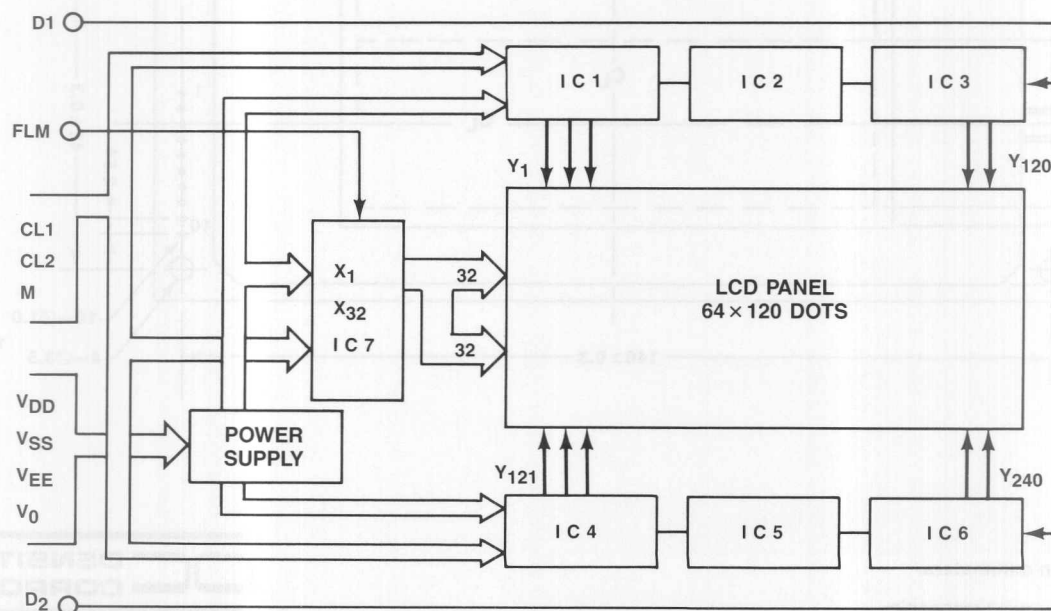
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}	—	-4.75	-5.0	-5.25	V
Current Consumption	I_{DD}	$f_{CL2} = 230\text{KHz}$ $D_1, D_2 = \text{GND}$	—	1.5	—	mA
	I_{EE}		—	1.1	—	mA
Clock Frequency	f_{CL2}	—	190	230	310	KHz
LC Drive Voltage (1/32 duty cycle)	$V_{DD}-V_0$	Temp = 0°C	—	9.0	—	V
		Temp = 25°C	—	8.3	—	V
		Temp = 40°C	—	7.6	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD}	0	6.0	V
LCD Drive Voltage	$V_{DD}-V_{EE}$	0	16.0	V
Temperature-Operating	T_{op}	0	40	°C
Temperature-Storage	T_{stg}	-20	60	°C

BLOCK DIAGRAM

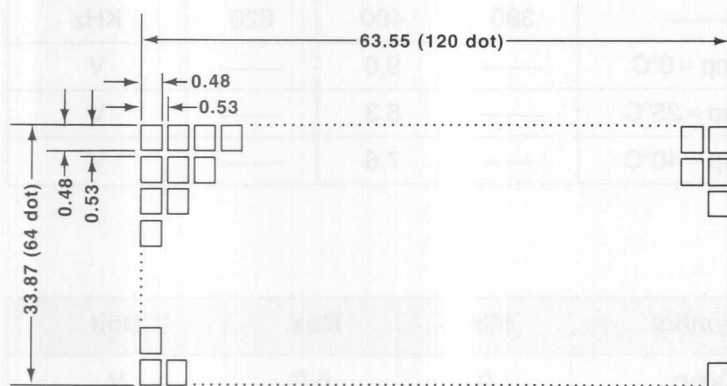


CONNECTOR ASSIGNMENT

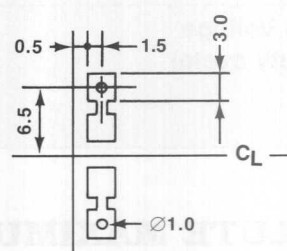
Pin No.	Symbol	Function
1	D1	Display data H...Dot on, L...Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

Pin No.	Symbol	Function
6	D2	Display data H...Dot on, L...Dot off
7	VDD	Power supply for logic circuit
8	VSS	Ground
9	VEE	Power supply for LC drivers
10	V0	Operating voltage for LC drivers

DISPLAY PATTERN

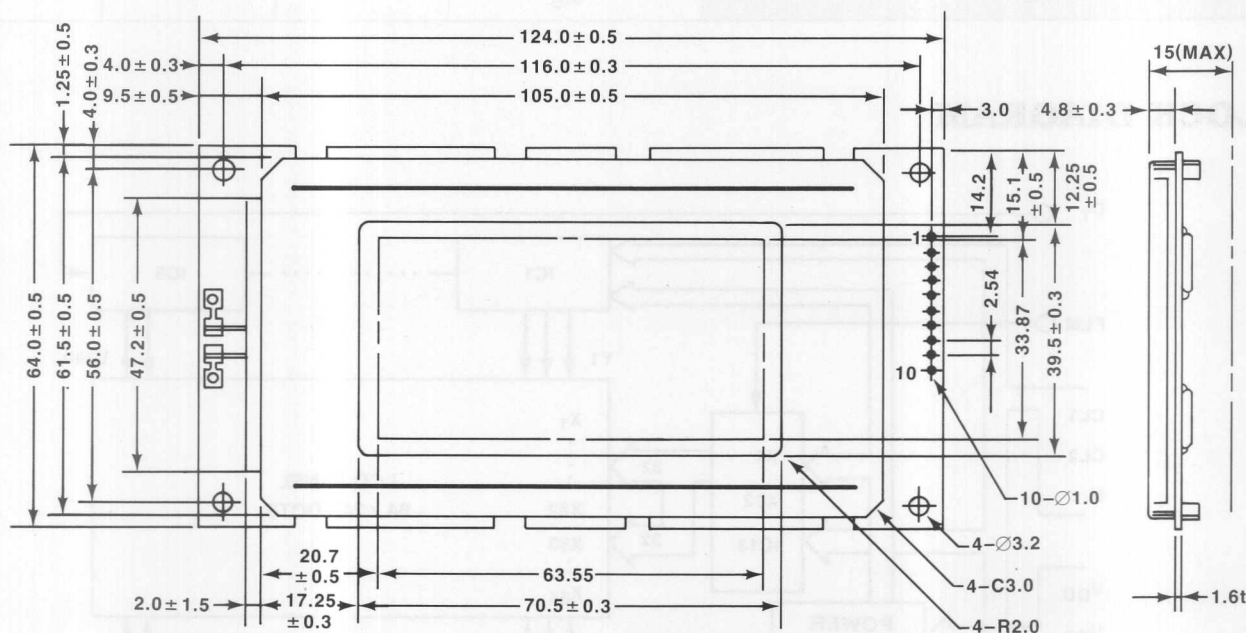


BACKLIGHT CONNECTION



EL PAD

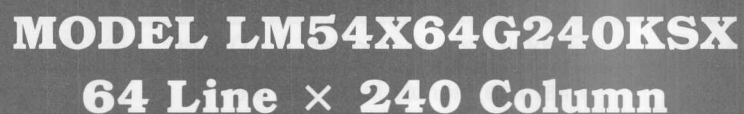
DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1001GC

DC DENSITRON CORPORATION



Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	——	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	——	− 4.75	− 5.0	− 5.25	V
Current Consumption	I _{DD}	f _{CL2} = 460KHz D1, D2 = GND	——	3.5	——	mA
	I _{EE}		——	2.2	——	mA
Clock Frequency	f _{CL2}	——	380	460	620	KHz
LC Drive Voltage (1/32 duty cycle)	V _{DD-V0}	Temp = 0°C	——	9.0	——	V
		Temp = 25°C	——	8.3	——	V
		Temp = 40°C	——	7.6	——	V

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	16.0	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	−20	60	°C

The block diagram illustrates the system architecture for the LCD panel. It includes the following components and connections:

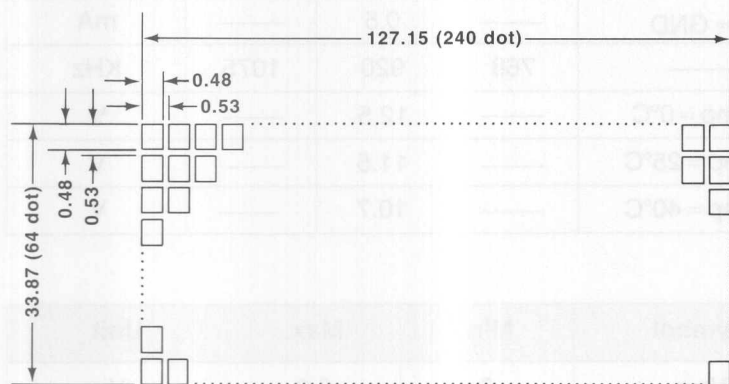
- Microcontroller (IC1 to IC6):** A series of microcontroller blocks. IC1 is connected to D1, FLM, CL1, CL2, M, and VDD. IC6 is connected to Y241 and Y480.
- Power Supply:** Receives VDD, VSS, VEE, and V0. It provides power to the LCD panel and the microcontroller blocks.
- LCD Panel (64 x 240 DOTS):** The central display component. It has 64 horizontal rows (X1 to X64) and 240 vertical columns (Y1 to Y241 to Y480).
- Control Logic (IC13, X1, X32):** These blocks manage the data flow between the microcontroller and the LCD panel. IC13 is connected to the microcontroller and the LCD panel. X1 and X32 are control logic blocks that manage the data flow between the microcontroller and the LCD panel.
- Microcontroller (IC7 to IC12):** A series of microcontroller blocks. IC7 is connected to VDD, VSS, VEE, V0, and the LCD panel. IC12 is connected to Y241 and Y480.

CONNECTOR ASSIGNMENT

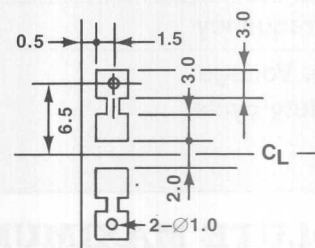
Pin No.	Symbol	Function
1	D ₁	Display data H...Dot on, L...Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

Pin No.	Symbol	Function
6	D ₂	Display data H...Dot on, L...Dot off
7	V _{DD}	Power supply for logic circuit
8	V _{SS}	Ground
9	V _{EE}	Power supply for LC drivers
10	V ₀	Operating voltage for LC drivers

DISPLAY PATTERN

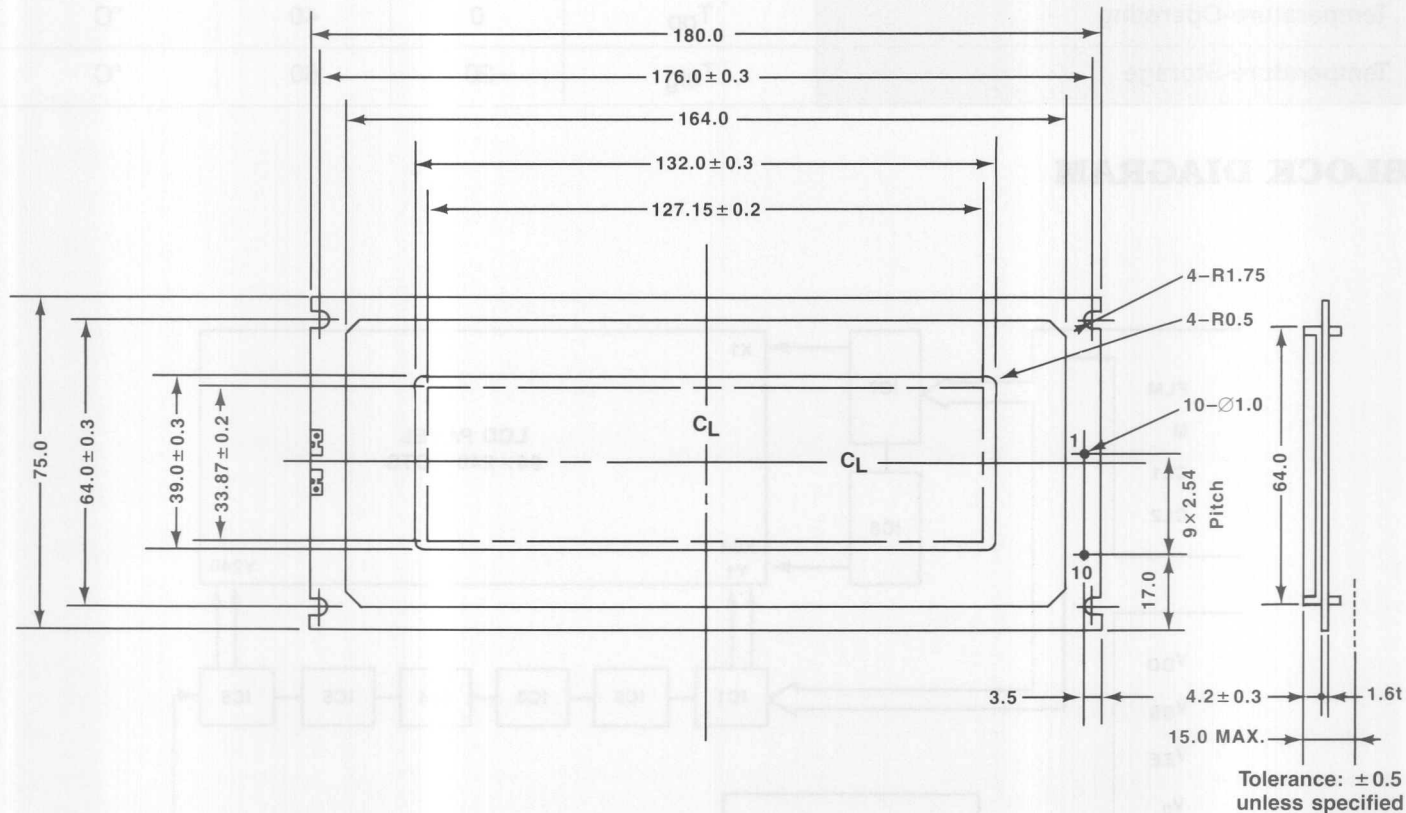


BACKLIGHT CONNECTION



EL PAD

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1001GC

DC DENSITRON CORPORATION

MODEL LM83X64G240DSX

64 Line × 240 Column

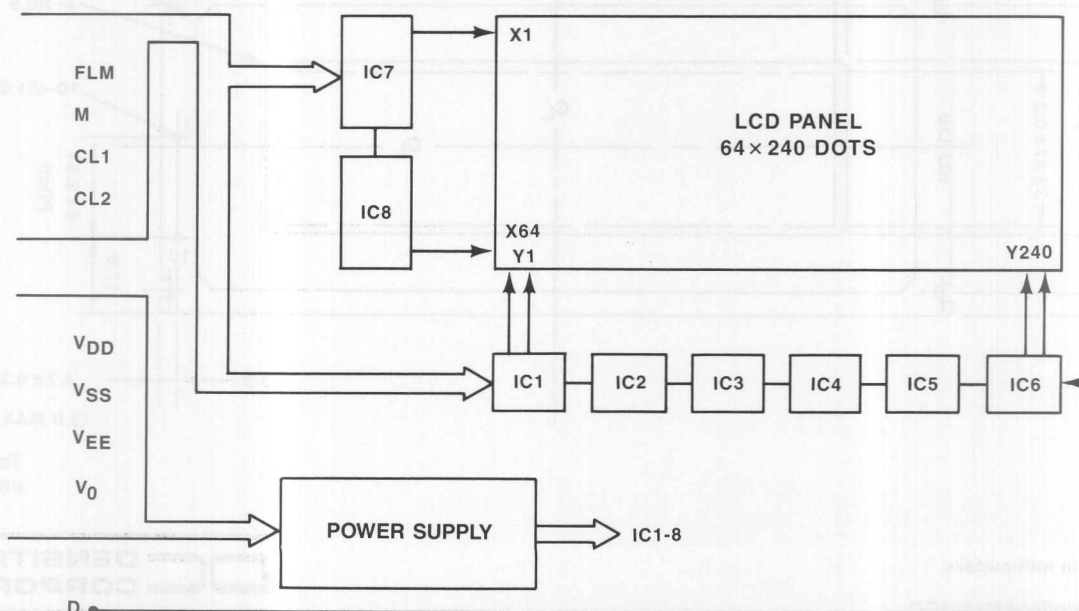
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	−9.5	−10.0	−10.5	V
Current Consumption	I _{DD}	f _{CL2} = 1.11MHz D = GND	—	2.5	—	mA
	I _{EE}		—	0.5	—	mA
Clock Frequency	f _{CL2}	—	768	920	1075	KHz
LC Drive Voltage (1/64 duty cycle)	V _{DD} - V ₀	Temp = 0°C	—	12.5	—	V
		Temp = 25°C	—	11.5	—	V
		Temp = 40°C	—	10.7	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} - V _{EE}	0	16.0	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	−20	60	°C

BLOCK DIAGRAM

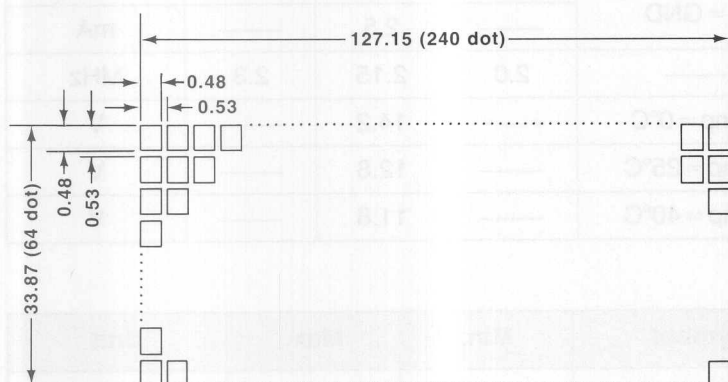


CONNECTOR ASSIGNMENT

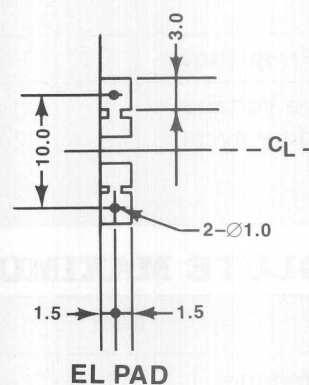
Pin No.	Symbol	Function
1	D	Display data H...Dot on, L...Dot off
2	FLM	The first line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

Pin No.	Symbol	Function
6	NC	—
7	V _{DD}	Power supply for logic circuit
8	V _{SS}	Ground
9	V _{EE}	Power supply for LC drivers
10	V ₀	Operating voltage for LC drivers

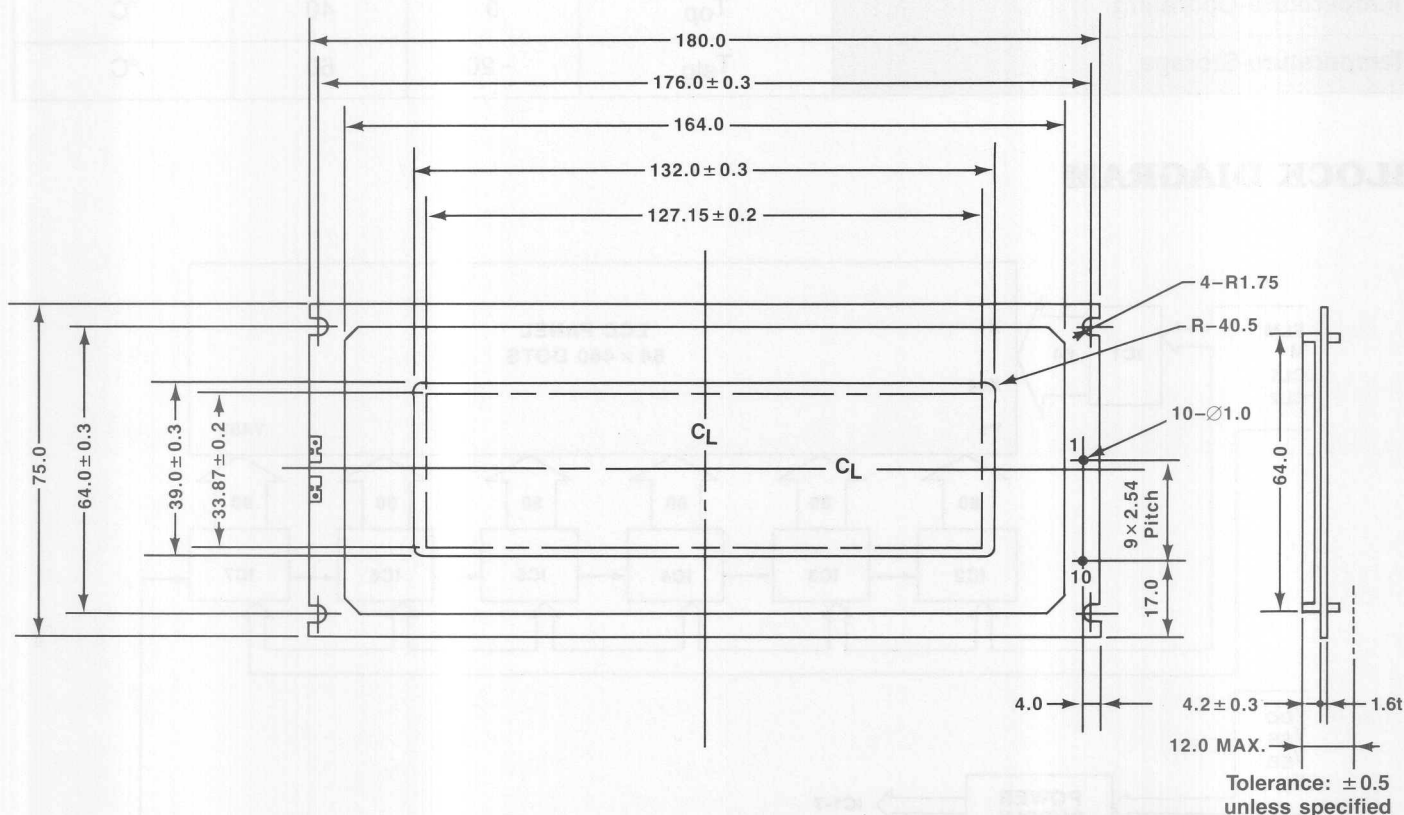
DISPLAY PATTERN



BACKLIGHT CONNECTION



DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1001GC

DC DENSITRON CORPORATION

MODEL LM95X64G480DSX
64 Line × 480 Column

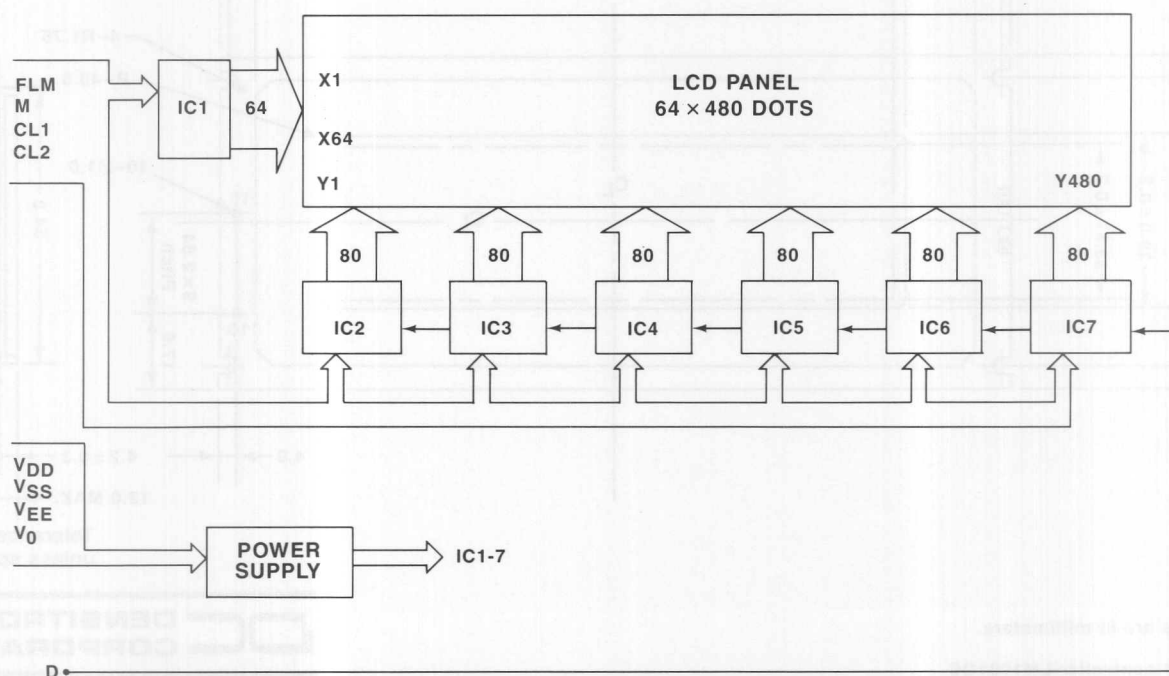
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-11.0	-12.0	-13.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.15MHz D = GND	—	6.0	—	mA
	I _{EE}		—	2.5	—	mA
Clock Frequency	f _{CL2}	—	2.0	2.15	2.3	MHz
LC Drive Voltage (1/64 duty cycle)	V _{DD} - V ₀	Temp = 0°C	—	14.2	—	V
		Temp = 25°C	—	12.8	—	V
		Temp = 40°C	—	11.8	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	18.0	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

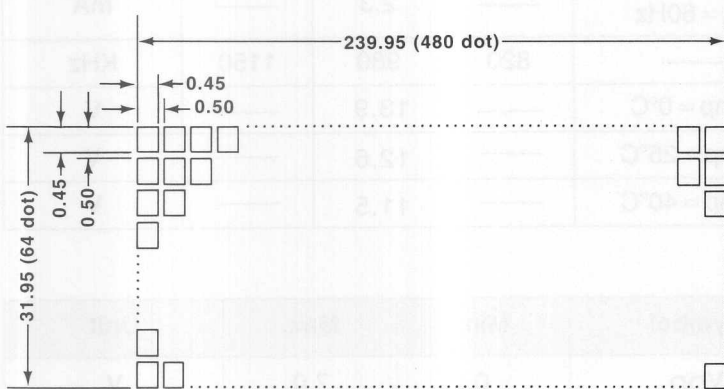


CONNECTOR ASSIGNMENT

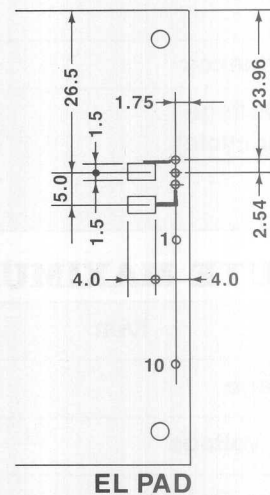
Pin No.	Symbol	Function
1	D	Display data H...Dot on, L...Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

Pin No.	Symbol	Function
6	NC	—
7	V _{DD}	Power supply for logic circuit
8	V _{SS}	Ground
9	V _{EE}	Power supply for LC drivers
10	V ₀	Operating voltage for LC drivers

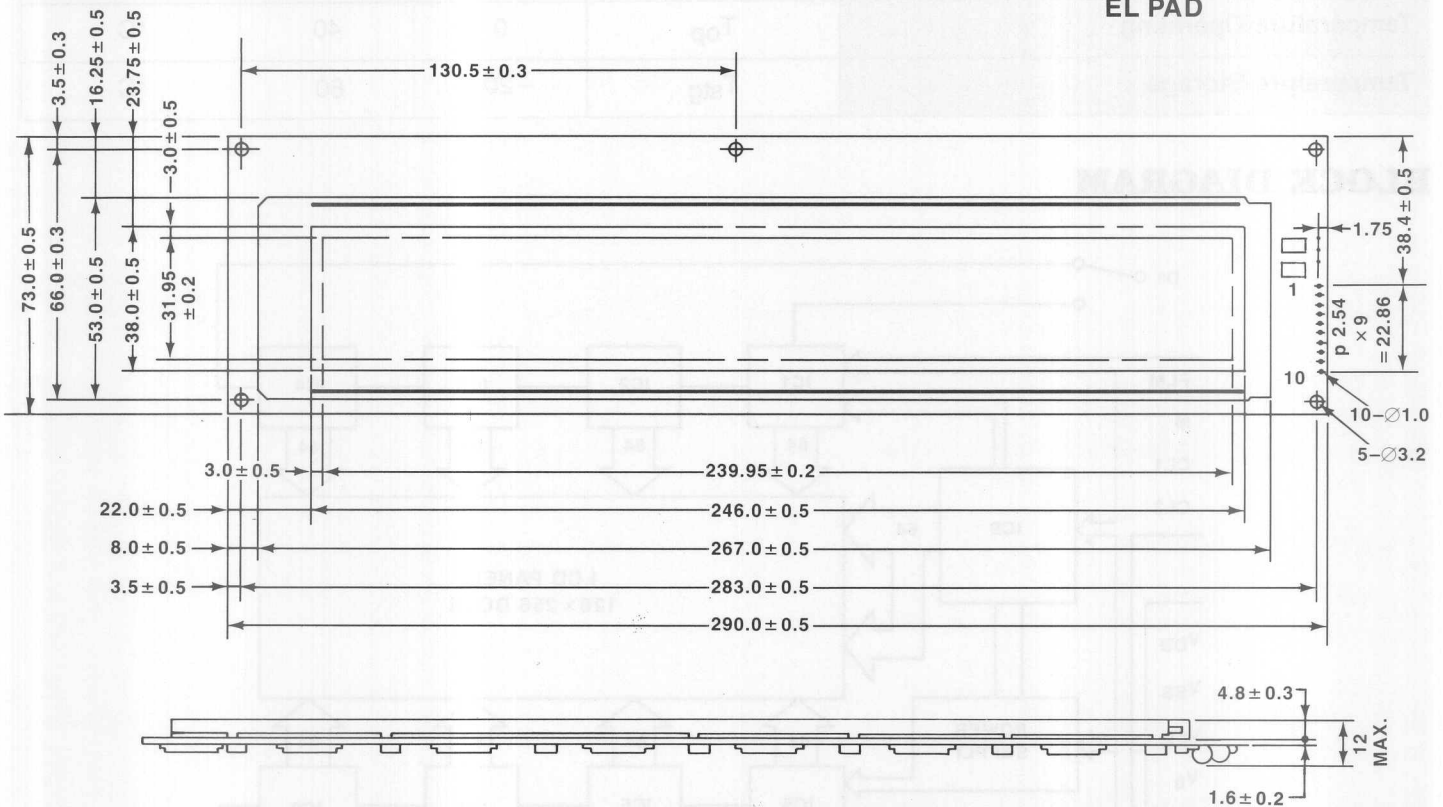
DISPLAY PATTERN



BACKLIGHT CONNECTION



DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1002GC.

DC DENSITRON CORPORATION

MODEL LM56X128G256DSX

128 Line × 256 Column

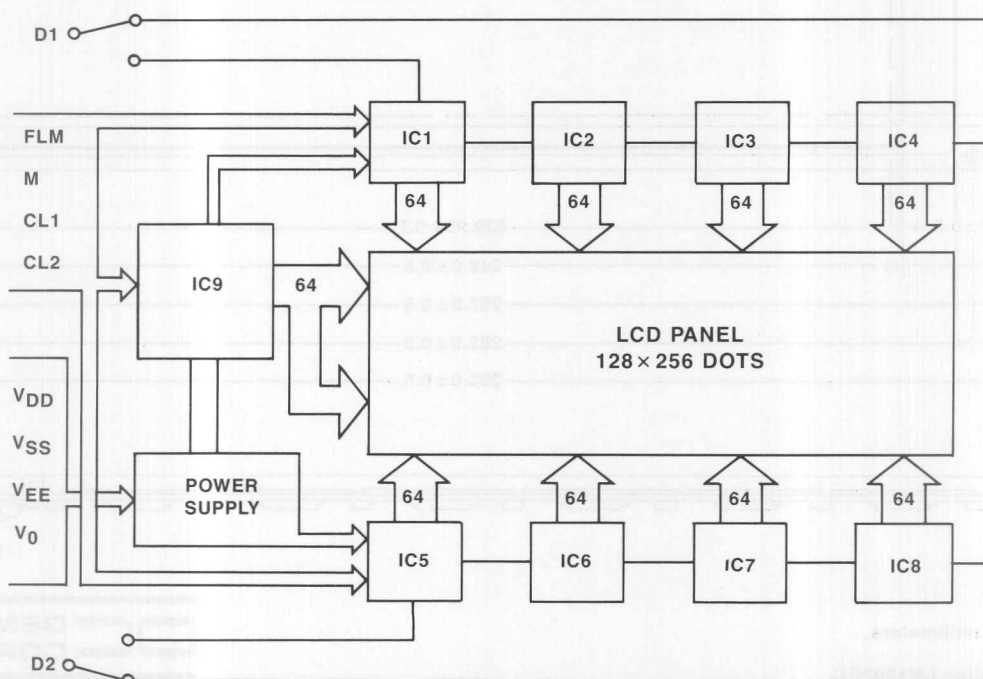
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-11.0	-12.0	-13.0	V
Current Consumption	I _{DD}	D ₁ , D ₂ = GND	—	5.2	—	mA
	I _{EE}	f _{CL2} = 980KHz f _M = 60Hz	—	2.3	—	mA
Clock Frequency	f _{CL2}	—	820	980	1150	KHz
LC Drive Voltage (1/64 duty cycle)	V _{DD} - V ₀	Temp = 0°C	—	13.9	—	V
		Temp = 25°C	—	12.6	—	V
		Temp = 40°C	—	11.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	-0.3	7.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	18.0	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

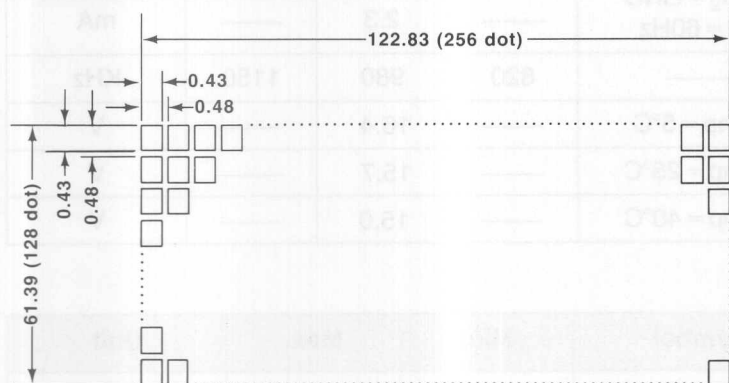


CONNECTOR ASSIGNMENT

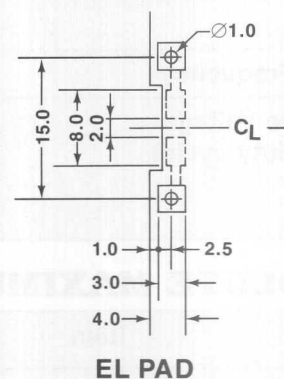
Pin No.	Symbol	Function
1	D ₁	Display data H...Dot on, L...Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	Clock signal for latching the serial data
5	CL2	Clock signal for shifting the serial data

Pin No.	Symbol	Function
6	D ₂	Display data H...Dot on, L...Dot off
7	V _{DD}	Power supply for logic circuit
8	V _{SS}	Ground
9	V _{EE}	Power supply for LC drivers
10	V ₀	Operating voltage for LC drivers

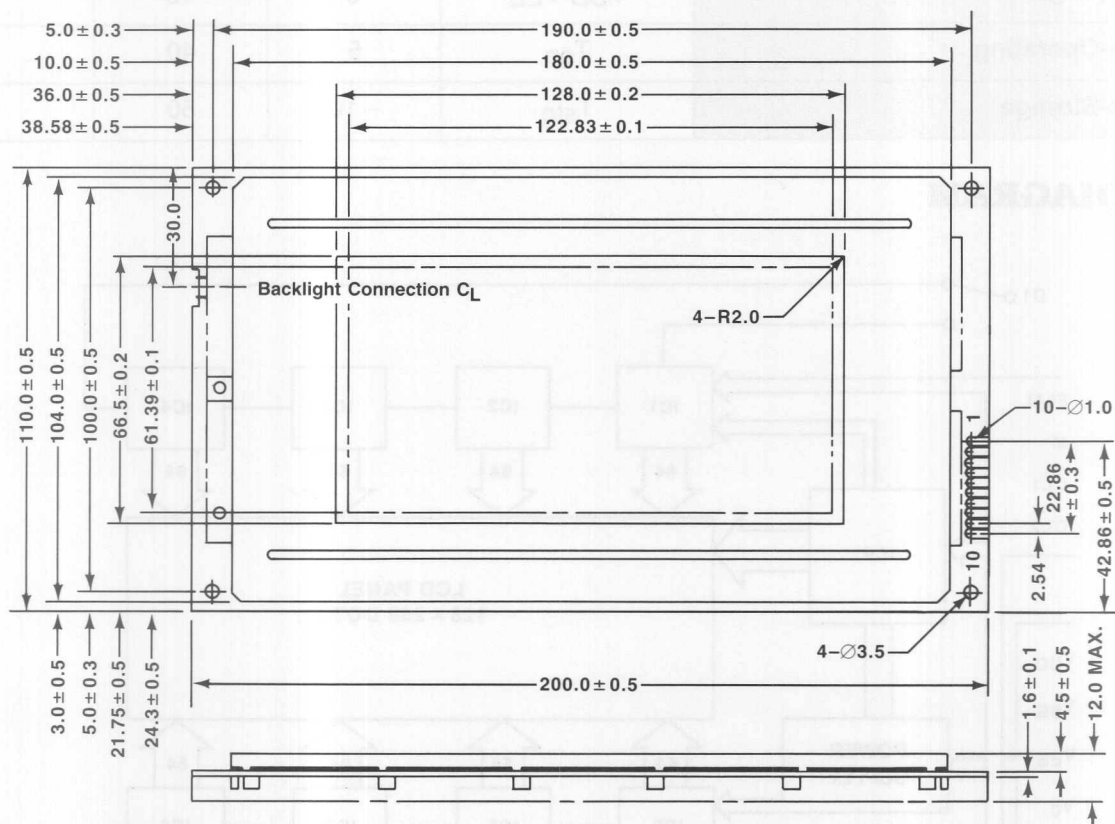
DISPLAY PATTERN



BACKLIGHT CONNECTION



DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1002GC.

MODEL LM656E128G256DSB

128 Line × 256 Column

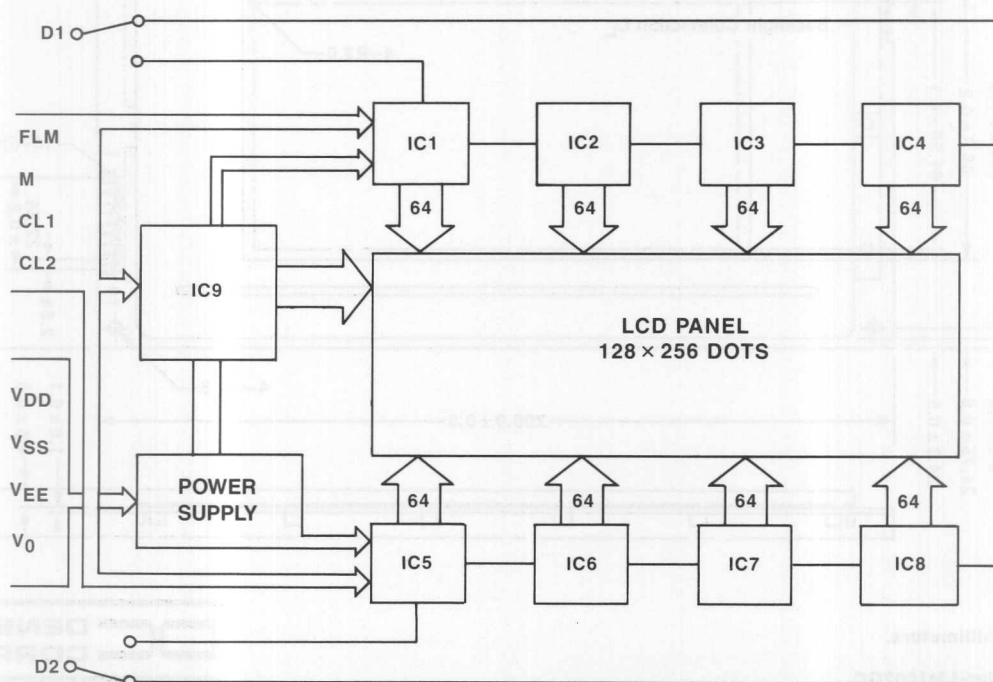
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-11.0	-12.0	-13.0	V
Current Consumption	I _{DD}	f _{CL2} = 980KHz D ₁ D ₂ = GND f _M = 60Hz	—	5.2	—	mA
	I _{EE}		—	2.3	—	mA
Clock Frequency	f _{CL2}	—	820	980	1150	KHz
LC Drive Voltage (1/64 duty cycle)	V _{DD} -V ₀	Temp = 5°C	—	16.4	—	V
		Temp = 25°C	—	15.7	—	V
		Temp = 40°C	—	15.0	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	-0.3	7.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	-0.3	18	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	-10	50	°C

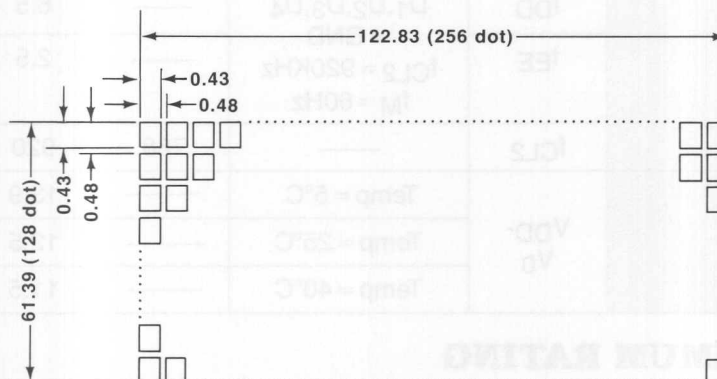
BLOCK DIAGRAM



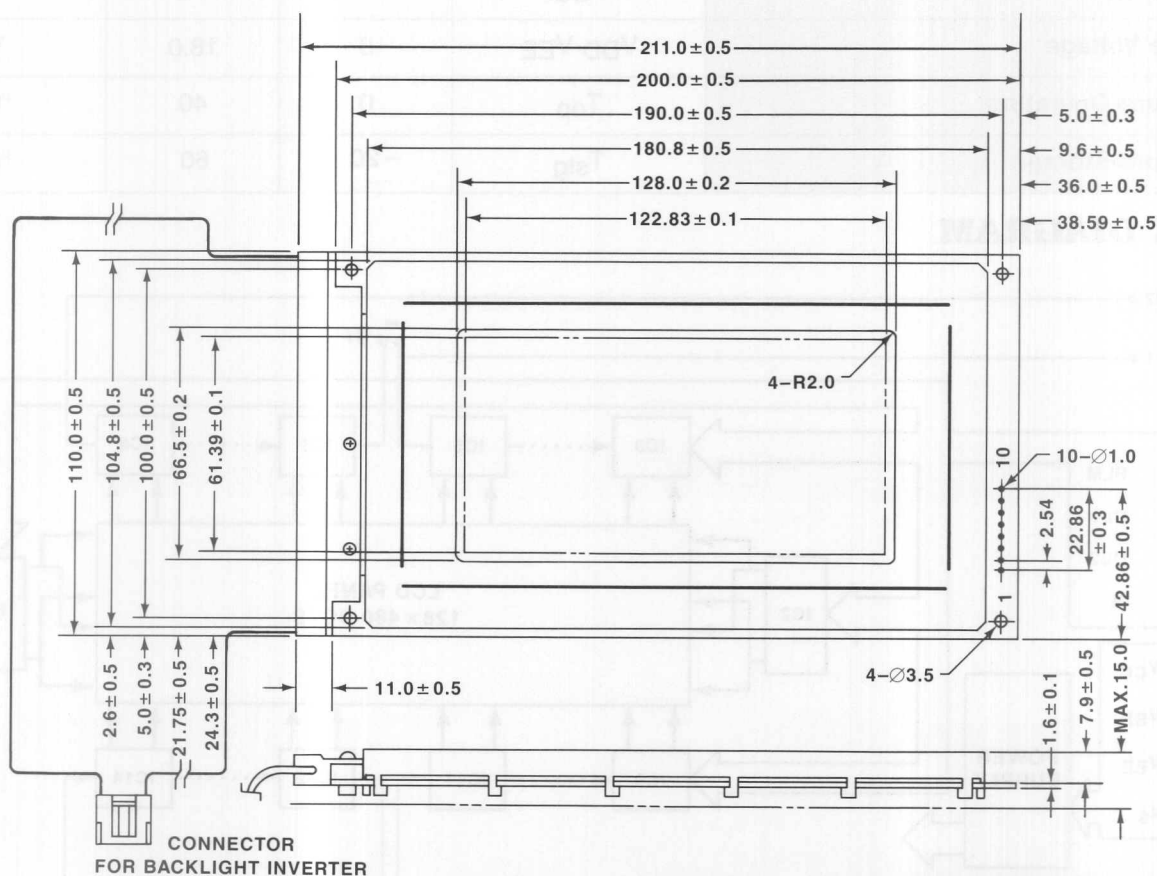
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	D1	Display data H...Dot on, L...Dot off	6	D2	Display data H...Dot on, L...Dot off
2	FLM	First line marker indicates the beginning of each display cycle	7	VDD	-5V
3	M	Control signal for AC drive	8	VSS	Ground
4	CL1	Clock signal for latching the serial data	9	VEE	Power supply for LC drivers
5	CL2	Clock signal for shifting the serial data	10	V0	Operating voltage for LC drivers

DISPLAY PATTERN



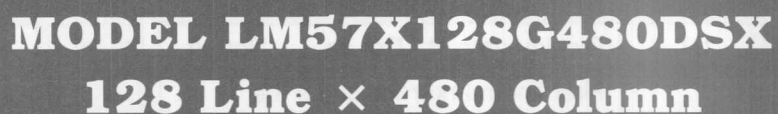
DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1002GC.

DC DENSITRON CORPORATION



Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	——	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	——	− 11.0	− 12.0	− 13.0	V
Current Consumption	I _{DD}	D ₁ ,D ₂ ,D ₃ ,D ₄ = GND f _{CL2} = 920KHz f _M = 60Hz	——	6.5	——	mA
	I _{EE}		——	2.5	——	mA
Clock Frequency	f _{CL2}	——	768	920	1075	KHz
LC Drive Voltage (1/64 duty cycle)	V _{DD} - V ₀	Temp = 5°C	——	13.9	——	V
		Temp = 25°C	——	12.5	——	V
		Temp = 40°C	——	11.5	——	V

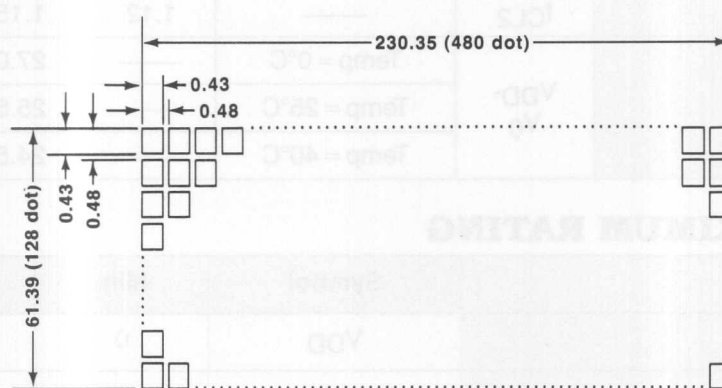
Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	− 0.3	7.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	18.0	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	− 20	60	°C

CONNECTOR ASSIGNMENT "A"

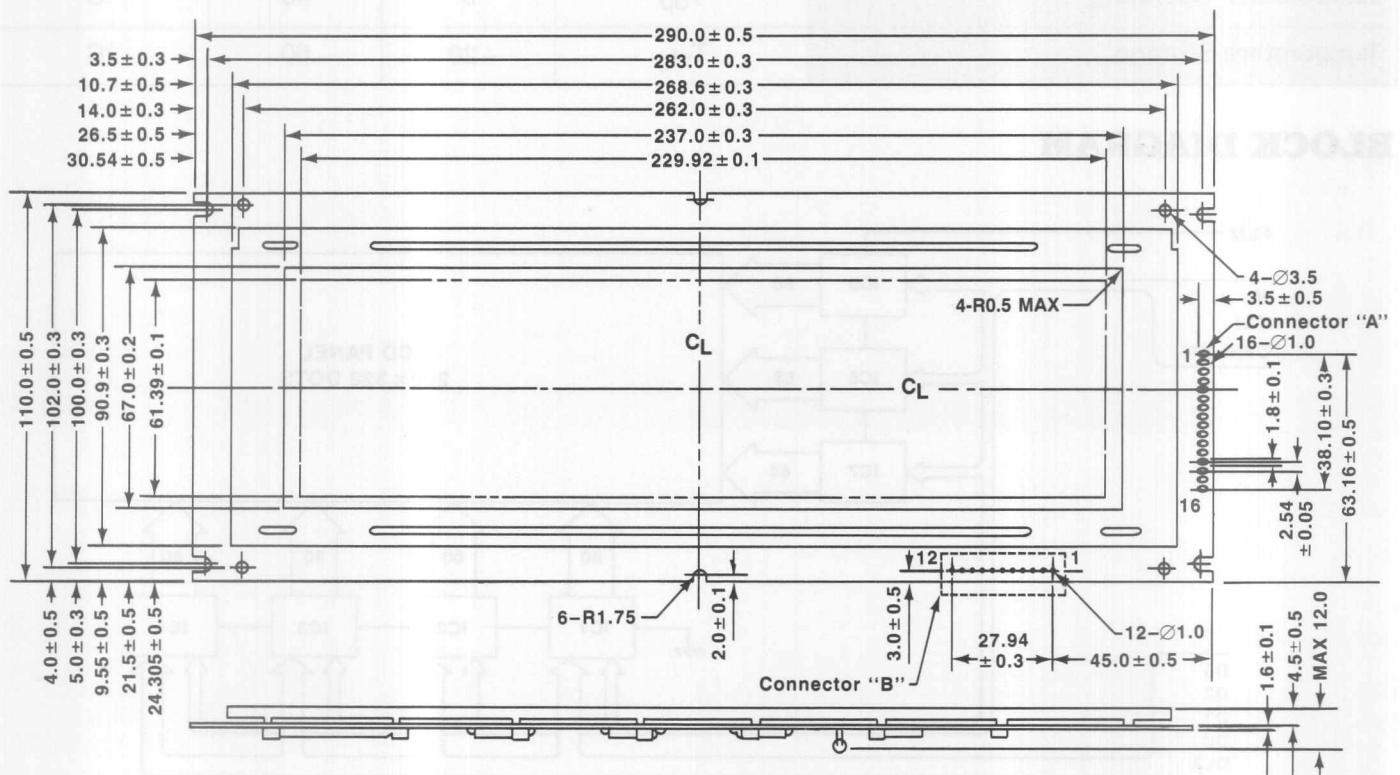
Pin No.	Symbol	Function
1	D2	Display data: upper right
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	Clock signal for latching the serial data
5	CL2	Clock signal for shifting the serial data
6	D4	Display data: Lower right
7	VDD	Power supply for logic (+5V)

Pin No.	Symbol	Function
8	VSS	Ground
9	VEE	Power supply for LC drivers
10	V ₀	Operating voltage for LC drivers
11	D ₁	Display data: Upper left
12	D ₃	Display data: Lower left
13	NC	No connect
14	EL	Power supply for EL backlight
15	NC	No connect
16	EL	Power supply for EL backlight

DISPLAY PATTERN



DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1006GC.

DC DENSITRON CORPORATION



Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	——	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	——	−21.0	−22.0	−23.0	V
Current Consumption	I _{DD}	f _{CL2} = 1.15MHz D ₀ ~D ₃ = GND	——	4.7	——	mA
	I _{EE}		——	3.7	——	mA
Clock Frequency	f _{CL2}	——	1.12	1.15	1.32	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD-V0}	Temp = 0°C	——	27.0	——	V
		Temp = 25°C	——	25.5	——	V
		Temp = 40°C	——	24.5	——	V

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	30	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	−20	60	°C

The block diagram illustrates the system architecture for the LCD panel. It includes the following components and connections:

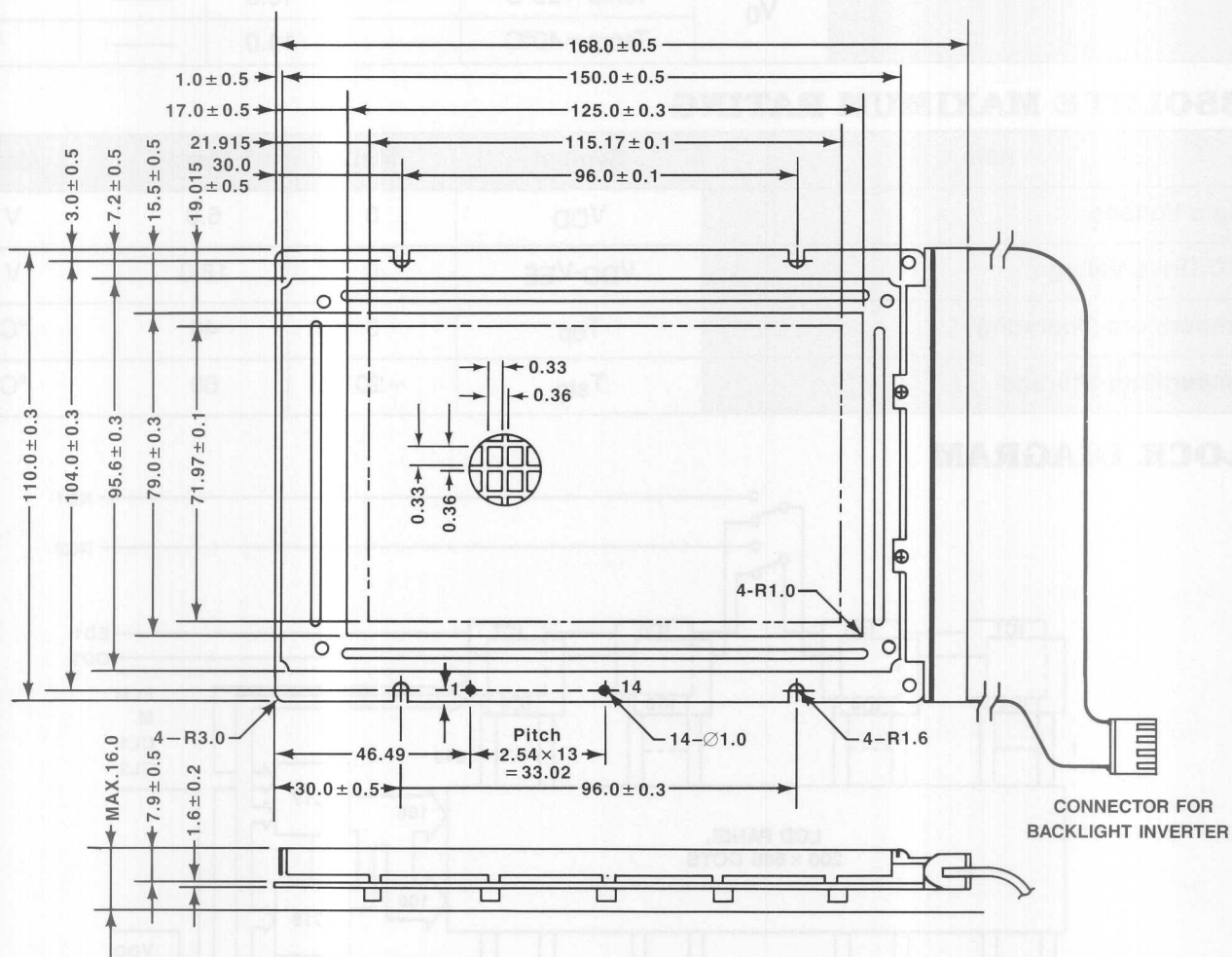
- FLM (Front Load Module):** Provides input signals **M**, **CL1**, and **DISP OFF** to the system.
- IC5, IC6, IC7:** These ICs receive signals from the FLM and output 68-bit and 64-bit data streams to the LCD panel.
- LCD PANEL (200 × 320 DOTS):** The central display unit that receives data from the ICs and outputs 80-bit signals to IC1 through IC4.
- IC1, IC2, IC3, IC4:** These ICs receive 80-bit signals from the LCD panel and output data to the power supply.
- POWER SUPPLY:** Receives input signals **VDD**, **VSS**, **VEE**, and **V0** and provides power to the ICs (IC1~IC7).

CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	DISP OFF	H...Display on, L...Display off
6	D ₀	Data 0 H...Dot on, L...Dot off

Pin No.	Symbol	Function
7	D ₁	Data 1 H...Dot on, L...Dot off
8	D ₂	Data 2 H...Dot on, L...Dot off
9	D ₃	Data 3 H...Dot on, L...Dot off
10	V _{DD}	+5V
11	V _{SS}	Ground
12	V _{EE}	Power supply for LC drivers
13	V ₀	Operating voltage for LC drivers
14	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-Consult factory.

DC DENSITRON CORPORATION

MODEL LM89X200G640DSX

200 Line × 640 Column

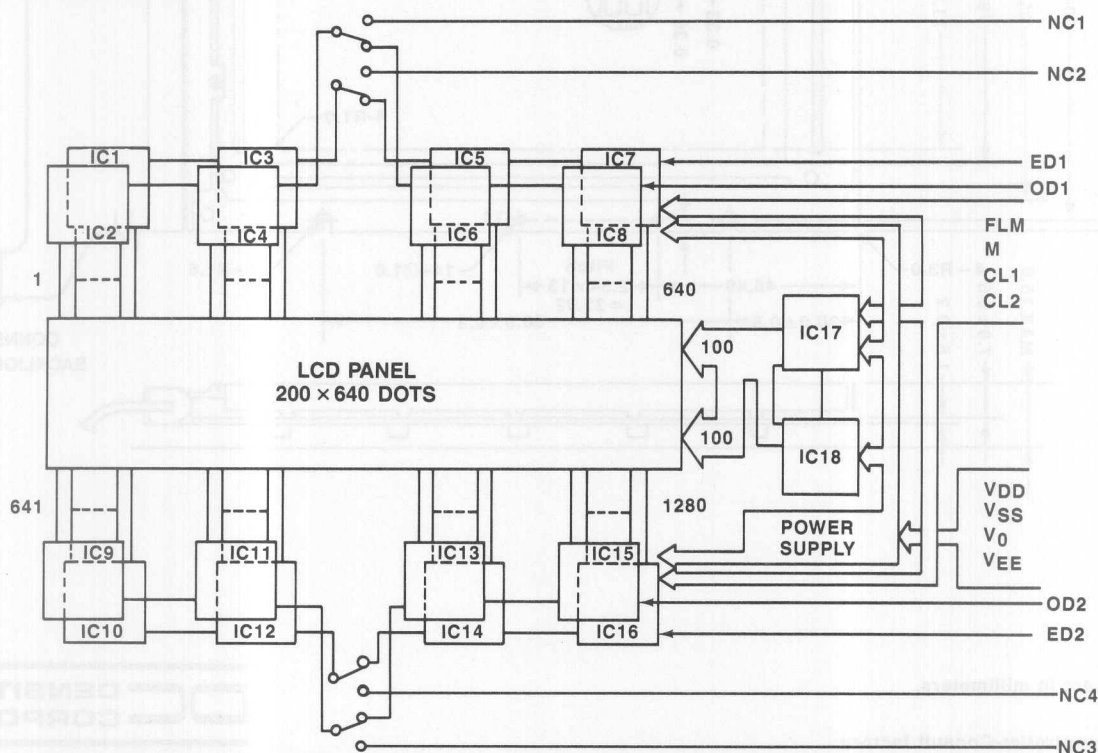
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-11.0	-12.0	-13.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.24MHz OD ₁ , OD ₂ = GND, ED ₁ , ED ₂ = GND	—	13	—	mA
	I _{EE}		—	3	—	mA
Clock Frequency	f _{CL2}	—	2.08	2.24	2.40	MHz
LC Drive Voltage (1/100 duty cycle)	V _{DD} - V _O	Temp = 0°C	—	16.2	—	V
		Temp = 25°C	—	15.0	—	V
		Temp = 40°C	—	14.0	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	18.0	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

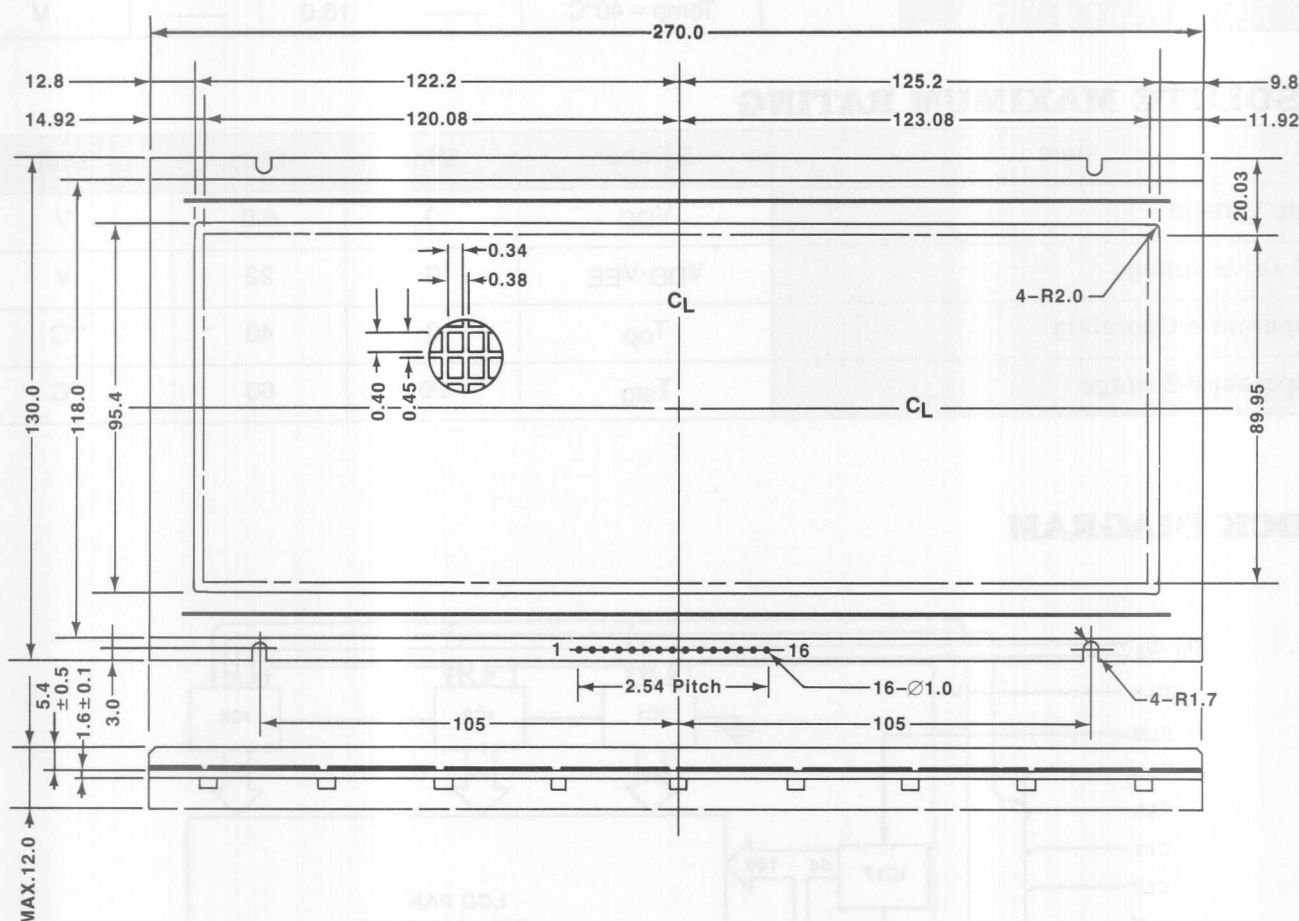
BLOCK DIAGRAM



CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle	8	ED ₁	Even data 1 H...Dot on, L...Dot off
2	M	Control signal for AC drive	9	NC3	—
3	CL1	The CL1 latches the serial data in the shift registers	10	NC4	—
4	CL2	Clock signal for shifting the serial data	11	OD ₂	Odd data 2 H...Dot on, L...Dot off
5	NC1	—	12	ED ₂	Even data 2 H...Dot on, L...Dot off
6	NC2	—	13	V _{DD}	Power supply for logic circuit
7	OD ₁	Odd data 1 H...Dot on, L...Dot off	14	V _{SS}	Ground
			15	V _{EE}	Power supply for LC drivers
			16	V ₀	Operating voltage for LC drivers

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-PCX10 Series.

DC DENSITRON
CORPORATION

MODEL LM91X200G640DSX

200 Line × 640 Column

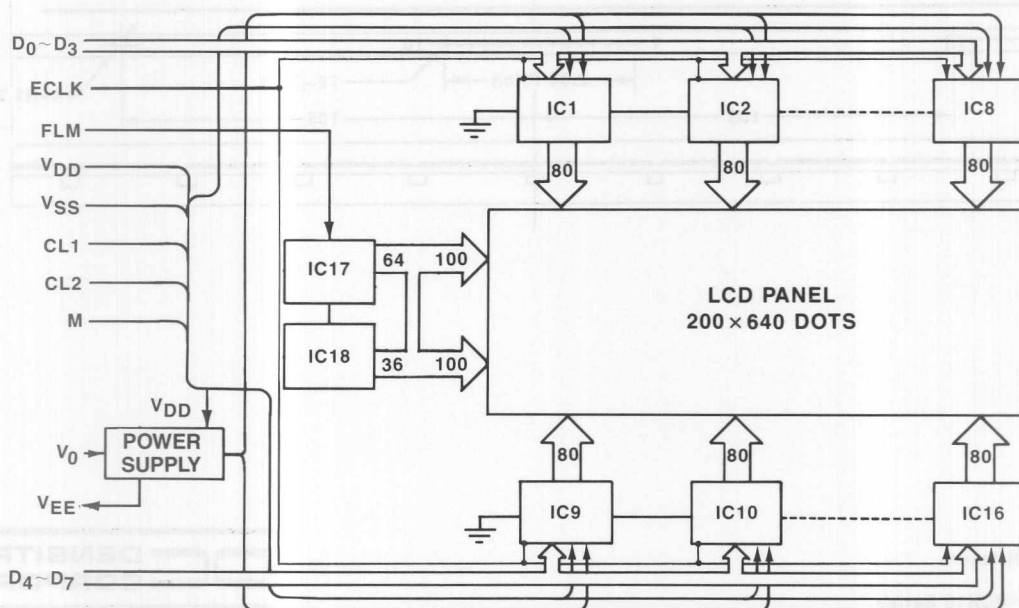
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-14.0	-15.0	-16.0	V
Current Consumption	I _{DD}	f _{CL2} = 1.15MHz D ₀ ~D ₇ = GND	—	5.5	—	mA
	I _{EE}		—	4.5	—	mA
Clock Frequency	f _{CL2}	—	1.12	1.15	1.20	MHz
LC Drive Voltage (1/100 duty cycle)	V _{DD} -V ₀	Temp = 0°C	—	18.6	—	V
		Temp = 25°C	—	17.0	—	V
		Temp = 40°C	—	16.0	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	22	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

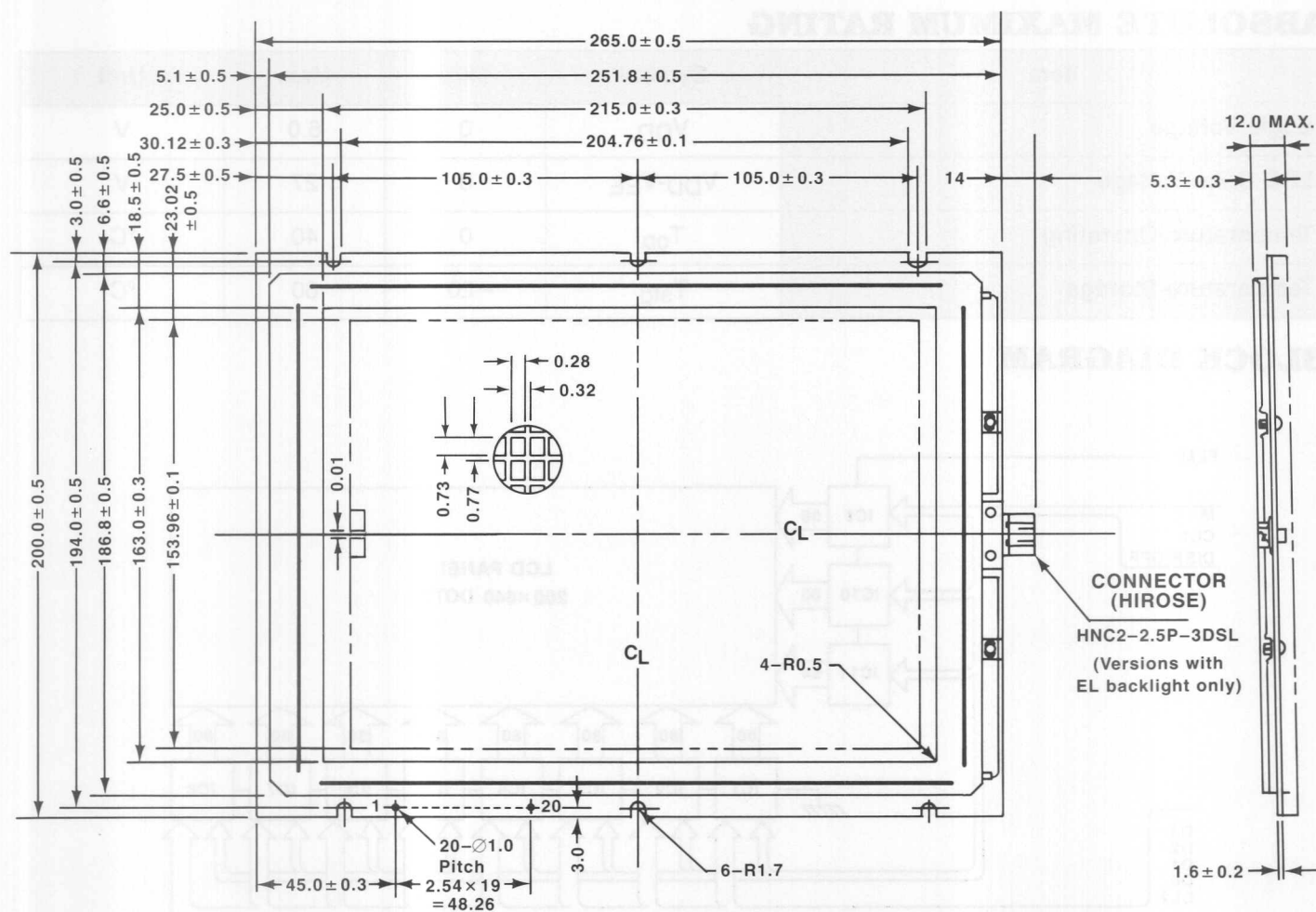


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	ECLK	Enable clock
6	D ₀	Data 0 H...Dot on, L...Dot off
7	D ₁	Data 1 H...Dot on, L...Dot off
8	D ₂	Data 2 H...Dot on, L...Dot off
9	D ₃	Data 3 H...Dot on, L...Dot off

Pin No.	Symbol	Function
10	D ₄	Data 4 H...Dot on, L...Dot off
11	D ₅	Data 5 H...Dot on, L...Dot off
12	D ₆	Data 6 H...Dot on, L...Dot off
13	D ₇	Data 7 H...Dot on, L...Dot off
14	V _{DD}	+5V
15	V _{SS}	Ground
16	V _{EE}	Power supply for LC drivers
17	V ₀	Operating voltage for LC drivers
18	V _{SS}	Ground
19	V _{DD}	+5V
20	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-PCX10 Series.

DC DENSITRON CORPORATION

MODEL LM205X200G640DSX

200 Line × 640 Column

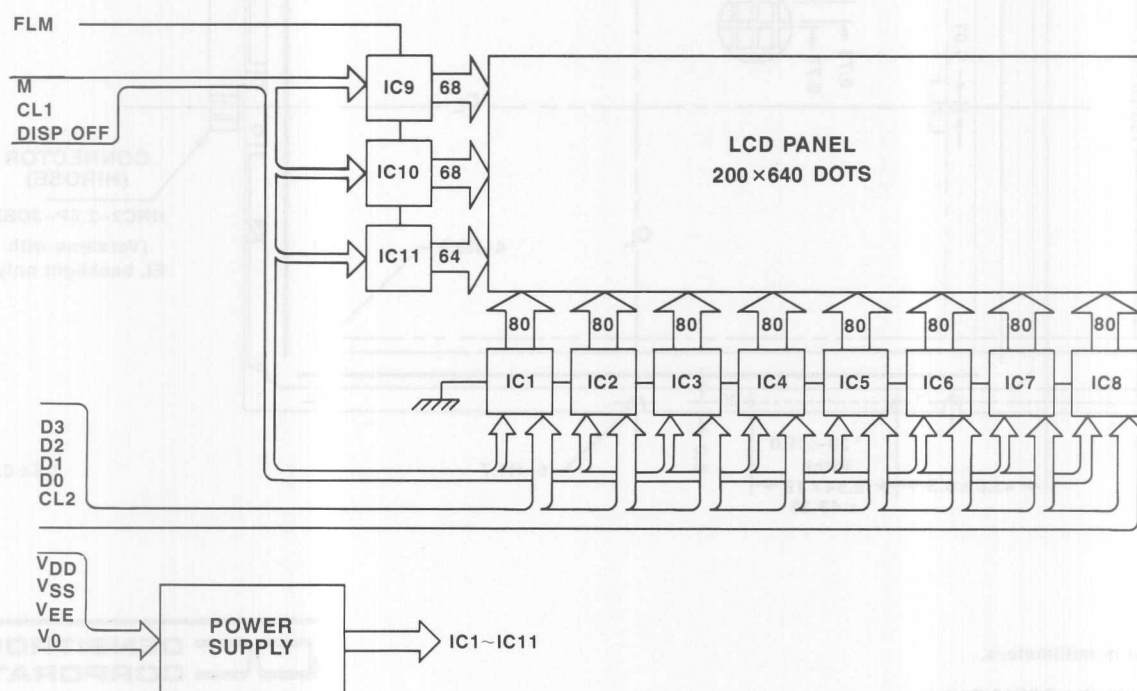
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-19.0	-20.0	-21.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.3MHz D ₀ ~D ₃ = GND	—	6.5	—	mA
	I _{EE}		—	5.0	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.3	2.4	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD-V0}	Temp = 0°C	—	—	25.0	V
		Temp = 25°C	—	22.3	—	V
		Temp = 40°C	18.0	—	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD-VEE}	0	27	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

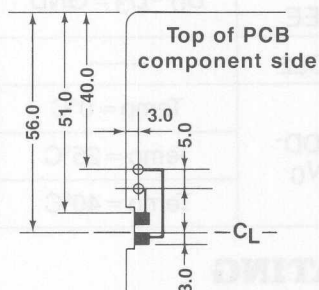


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	DISP OFF	H...Display on, L...Display off
6	D ₀	Data 0 H... Dot on, L...Dot off

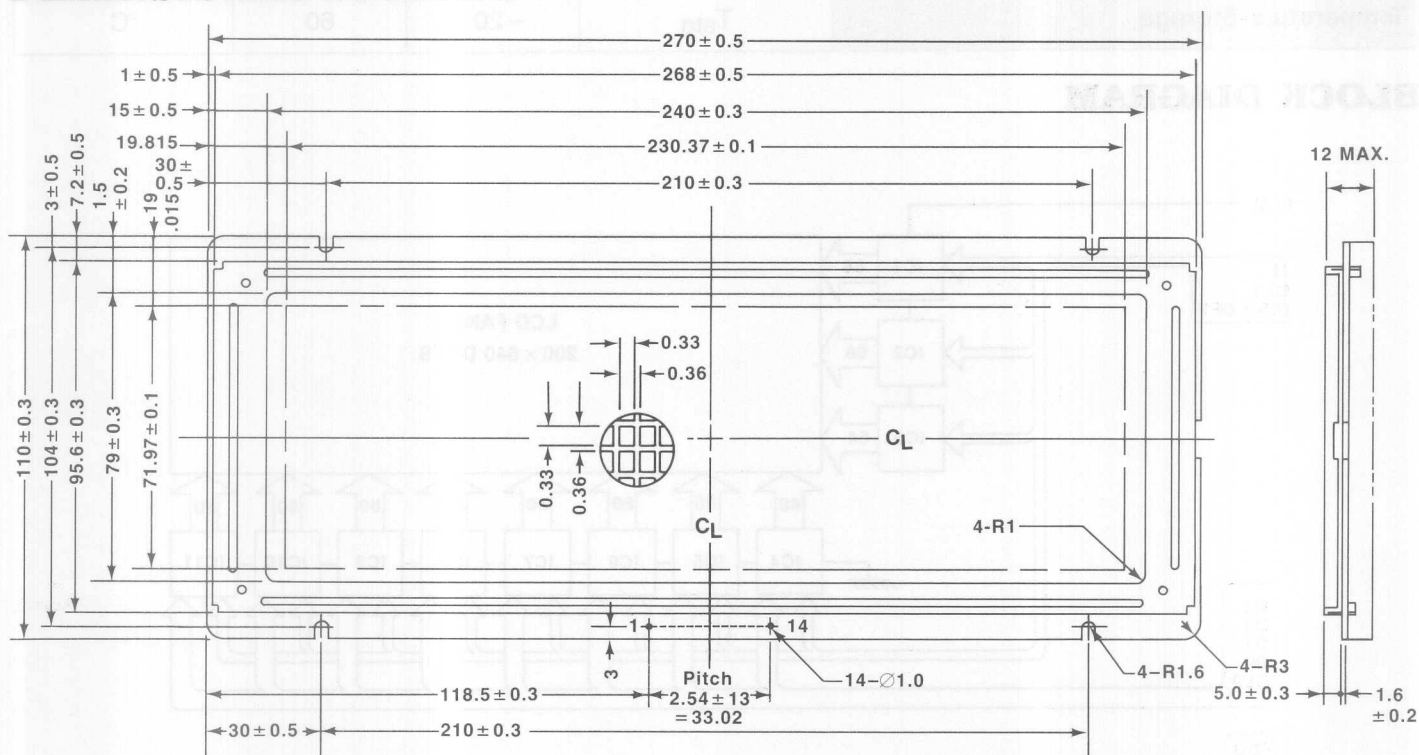
Pin No.	Symbol	Function
7	D ₁	Data 1 H...Dot on, L...Dot off
8	D ₂	Data 2 H...Dot on, L...Dot off
9	D ₃	Data 3 H...Dot on, L...Dot off
10	V _{DD}	+5V
11	VSS	Ground
12	V _{EE}	Power supply for LC drivers
13	V ₀	Operating voltage for LC drivers
14	NC	—

BACKLIGHT CONNECTION



EL PAD

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-B or PCX10 Series.

DC DENSITRON CORPORATION

MODEL LM240X200G640DSX

200 Line × 640 Column

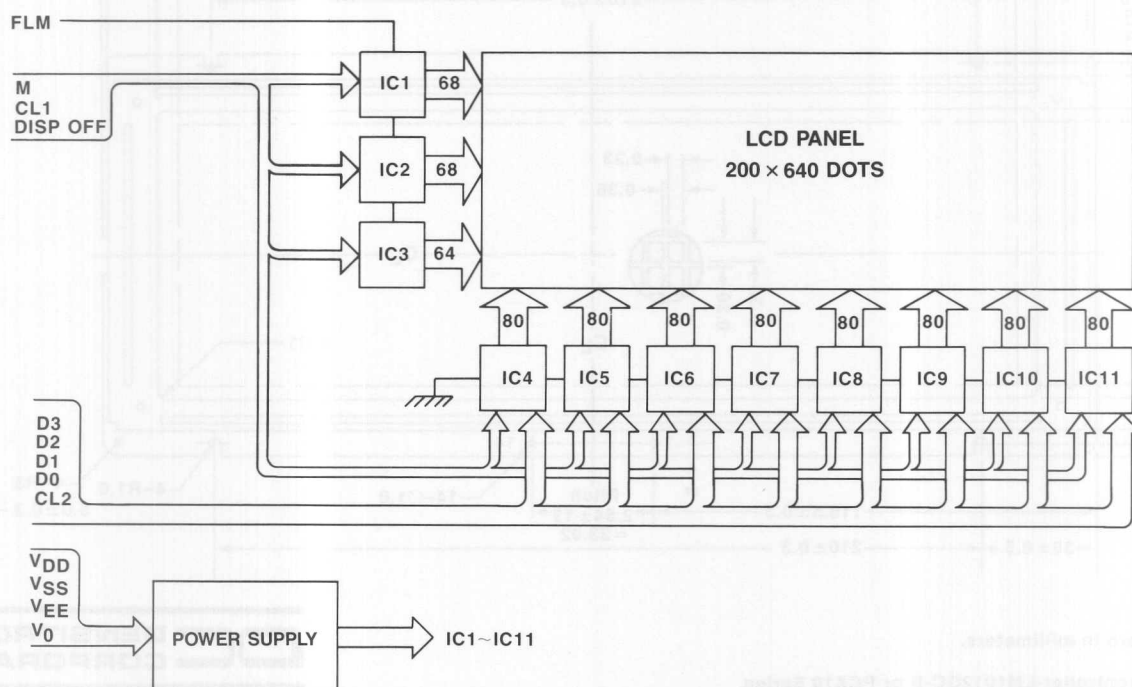
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-21.0	-22.0	-23.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.3MHz D ₀ ~D ₃ = GND	—	6.5	—	mA
	I _{EE}		—	5.0	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.3	2.4	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD-V0}	Temp = 0°C	—	—	25.0	V
		Temp = 25°C	—	22.3	—	V
		Temp = 40°C	18.0	—	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD-V_{EE}}	0	27	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

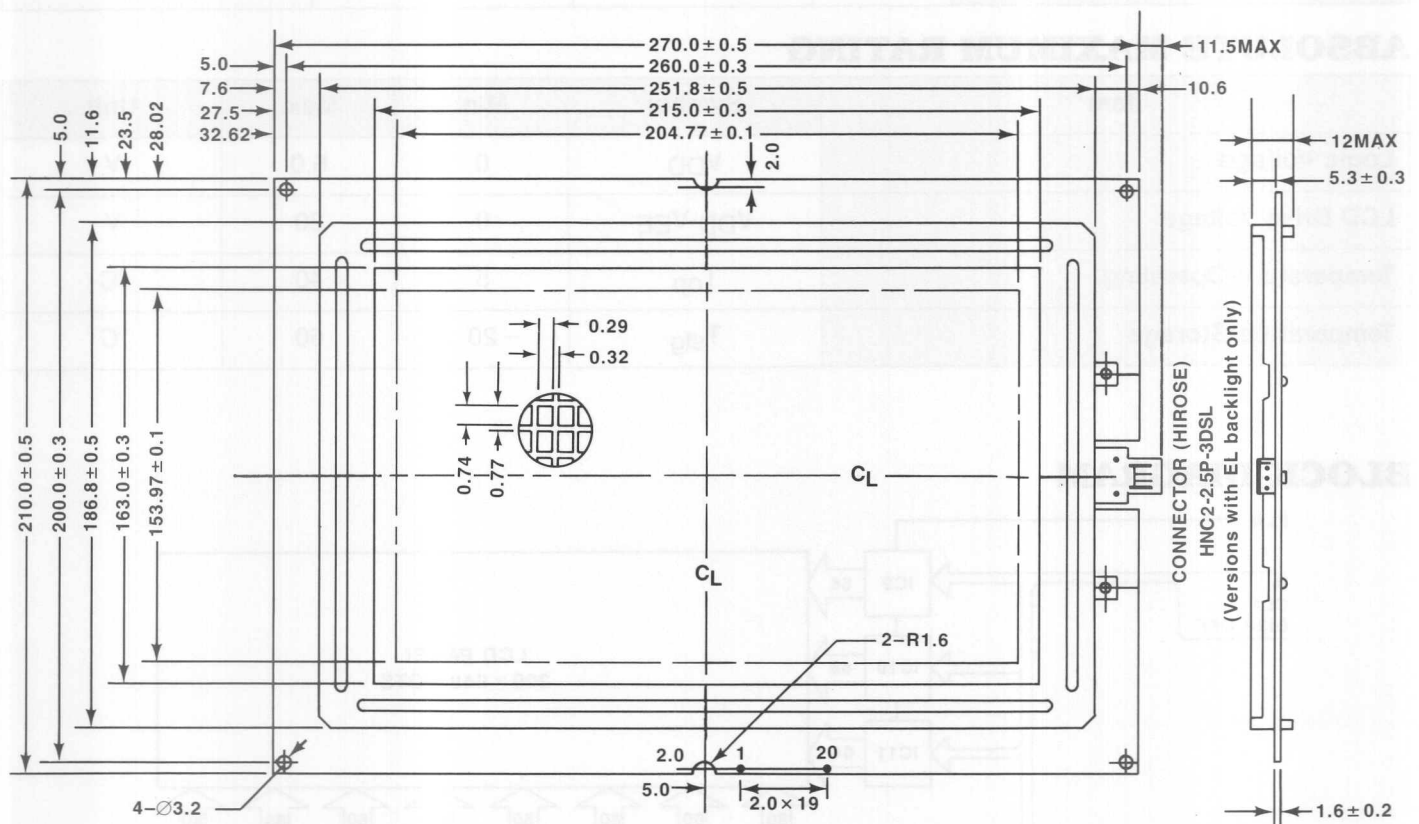


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	NC	—
6	D ₀	Display data 0 H...Dot on, L...Dot off
7	D ₁	Display data 1 H...Dot on, L...Dot off
8	D ₂	Display data 2 H...Dot on, L...Dot off
9	D ₃	Display data 3 H...Dot on, L...Dot off

Pin No.	Symbol	Function
10	NC	—
11	NC	—
12	NC	—
13	NC	—
14	V _{DD}	+5V
15	V _{SS}	Ground
16	V _{EE}	Power supply for LC drivers
17	V ₀	Operating voltage for LC drivers
18	DISP OFF	H... Display on, L... Display off
19	NC	—
20	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-B or PCX10 Series.

DC DENSITRON CORPORATION

MODEL LM645E200G640DSB

200 Line × 640 Column

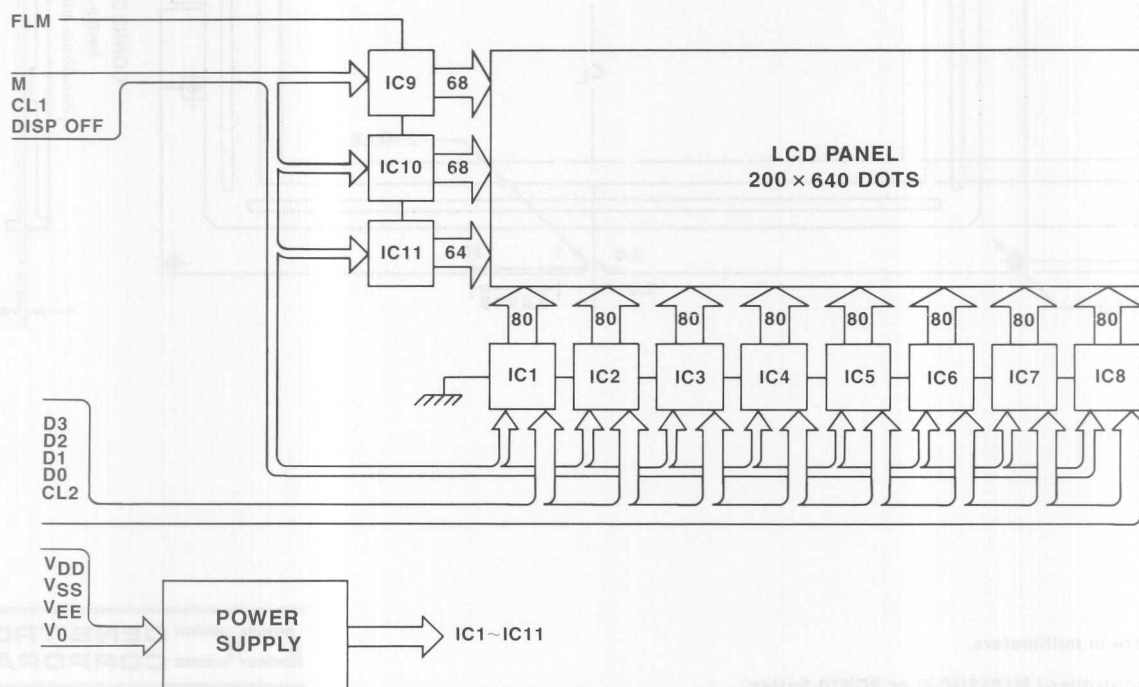
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}	—	-22.0	-23.0	-24.0	V
Current Consumption	I_{DD}	$f_{CL2} = 2.3\text{MHz}$ $D_0 \sim D_3 = \text{GND}$	—	6.5	—	mA
	I_{EE}		—	5.0	—	mA
Clock Frequency	f_{CL2}	—	2.24	2.3	2.64	MHz
LC Drive Voltage (1/200 duty cycle)	$V_{DD}-V_0$	Temp = 5°C	—	27.0	—	V
		Temp = 25°C	—	25.5	—	V
		Temp = 40°C	—	24.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD}	0	6.0	V
LCD Drive Voltage	$V_{DD}-V_{EE}$	0	30	V
Temperature-Operating	T_{op}	5	40	°C
Temperature-Storage	T_{stg}	-20	60	°C

BLOCK DIAGRAM

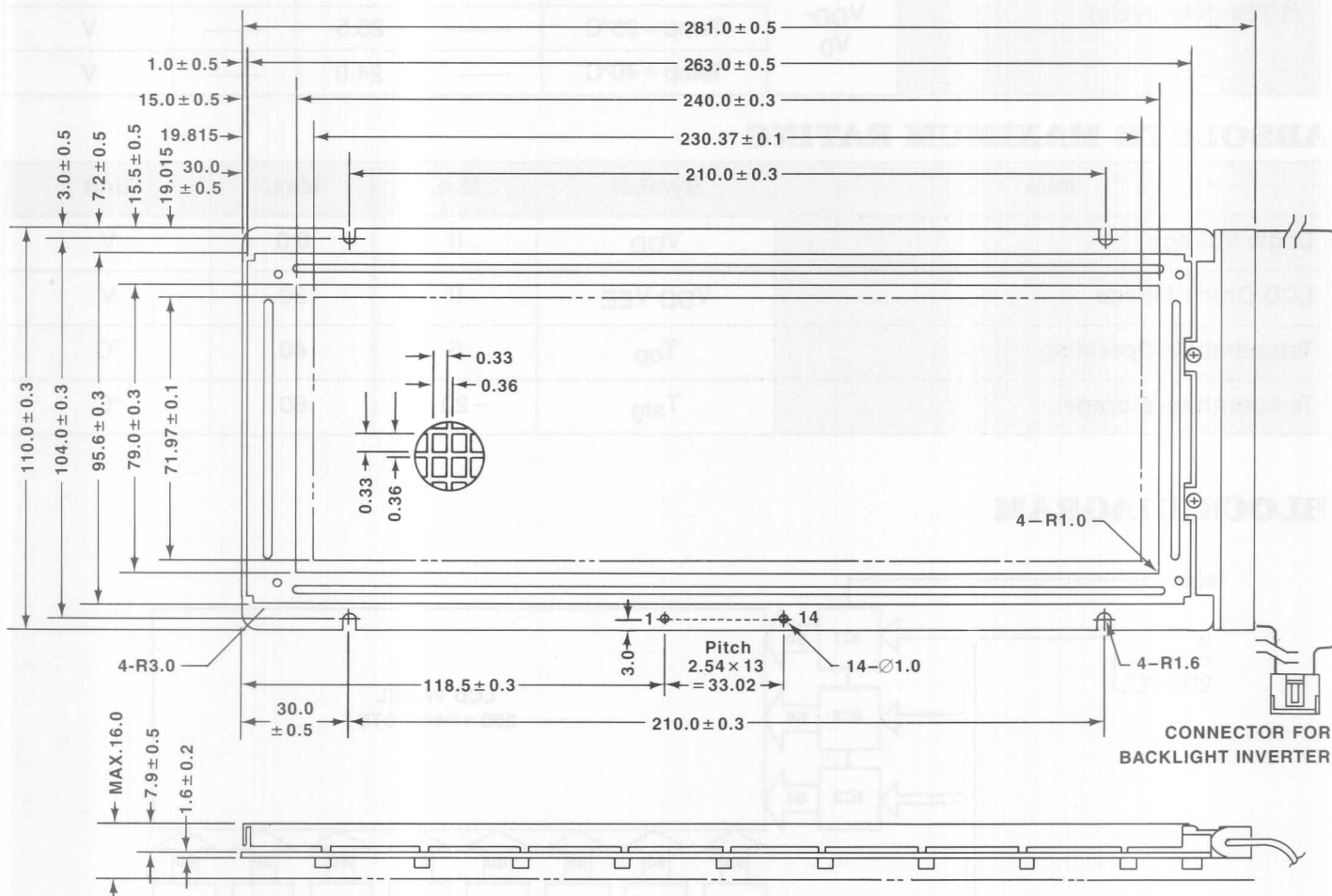


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	DISP OFF	H...Display on, L...Display off
6	D ₀	Data 0 H...Dot on, L...Dot off

Pin No.	Symbol	Function
7	D ₁	Data 1 H...Dot on, L...Dot off
8	D ₂	Data 2 H...Dot on, L...Dot off
9	D ₃	Data 3 H...Dot on, L...Dot off
10	V _{DD}	+5V
11	V _{SS}	Ground
12	V _{EE}	Power supply for LC drivers
13	V ₀	Operating voltage for LC drivers
14	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-B or PCX10 Series.

DC DENSITRON CORPORATION

MODEL LM678E200G640DSB

200 Line × 640 Column

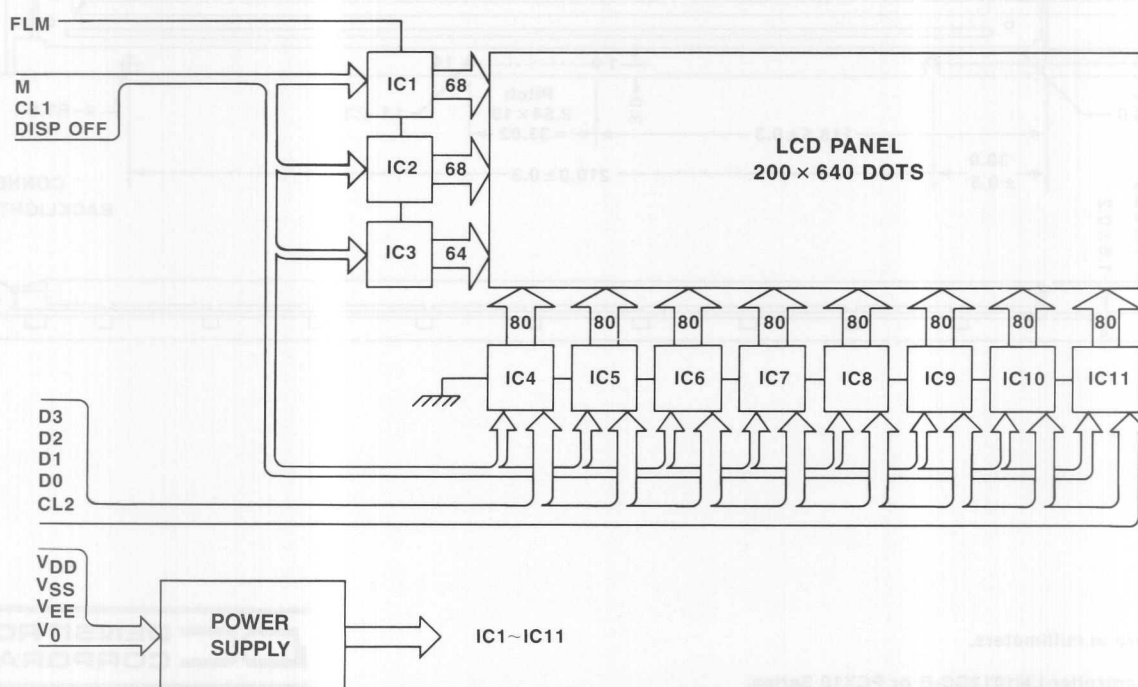
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-21.0	-22.0	-23.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.3MHz D0~D3 = GND	—	9.0	—	mA
	I _{EE}		—	7.5	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.3	2.4	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD-V0}	Temp = 5°C	—	27.0	—	V
		Temp = 25°C	—	25.5	—	V
		Temp = 40°C	—	24.0	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD-V_{EE}}	0	30	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

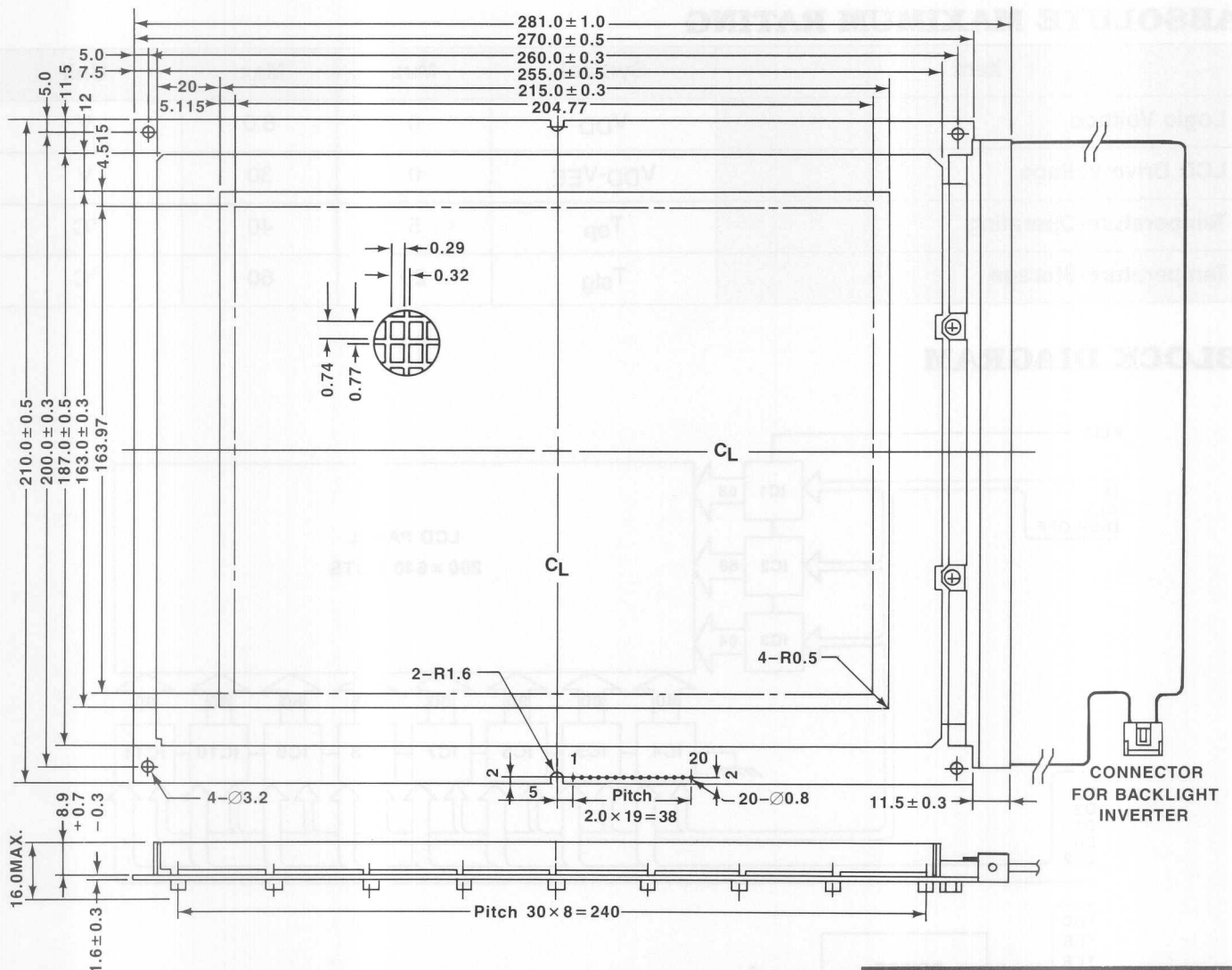


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	NC	—
6	D ₀	Data H...Dot on, L...Dot off
7	D ₁	Data H...Dot on, L...Dot off
8	D ₂	Data H...Dot on, L...Dot off
9	D ₃	Data H...Dot on, L...Dot off

Pin No.	Symbol	Function
10	NC	—
11	NC	—
12	NC	—
13	NC	—
14	V _{DD}	+5V
15	V _{SS}	Ground
16	V _{EE}	Power supply for LC drivers
17	V ₀	Operating voltage for LC drivers
18	DISP OFF	H...Display on, L...Display off
19	NC	—
20	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-B or PCX10 Series.

DC DENSITRON
CORPORATION

MODEL LM879E200G640DSW

200 Line × 640 Column

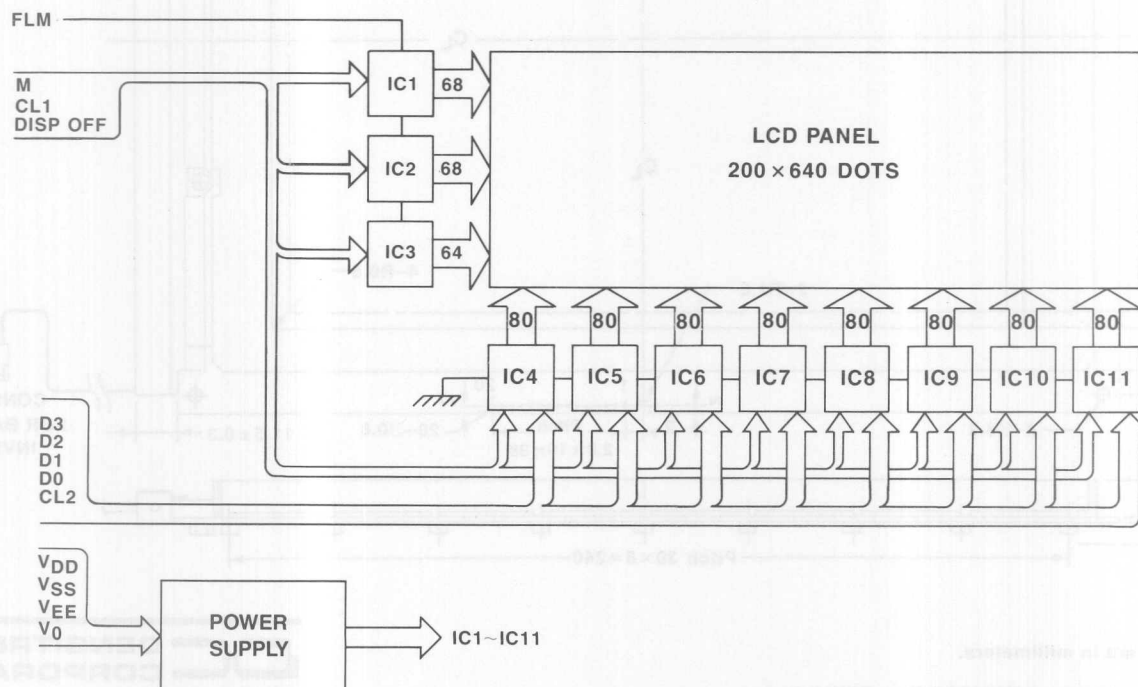
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-21.0	-22.0	-23.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.3MHz	—	9.0	—	mA
	I _{EE}	D ₀ ~D ₃ = GND	—	7.5	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.3	2.4	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD} - V ₀	Temp = 5°C	—	27.0	—	V
		Temp = 25°C	—	25.5	—	V
		Temp = 40°C	—	24.0	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	30	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

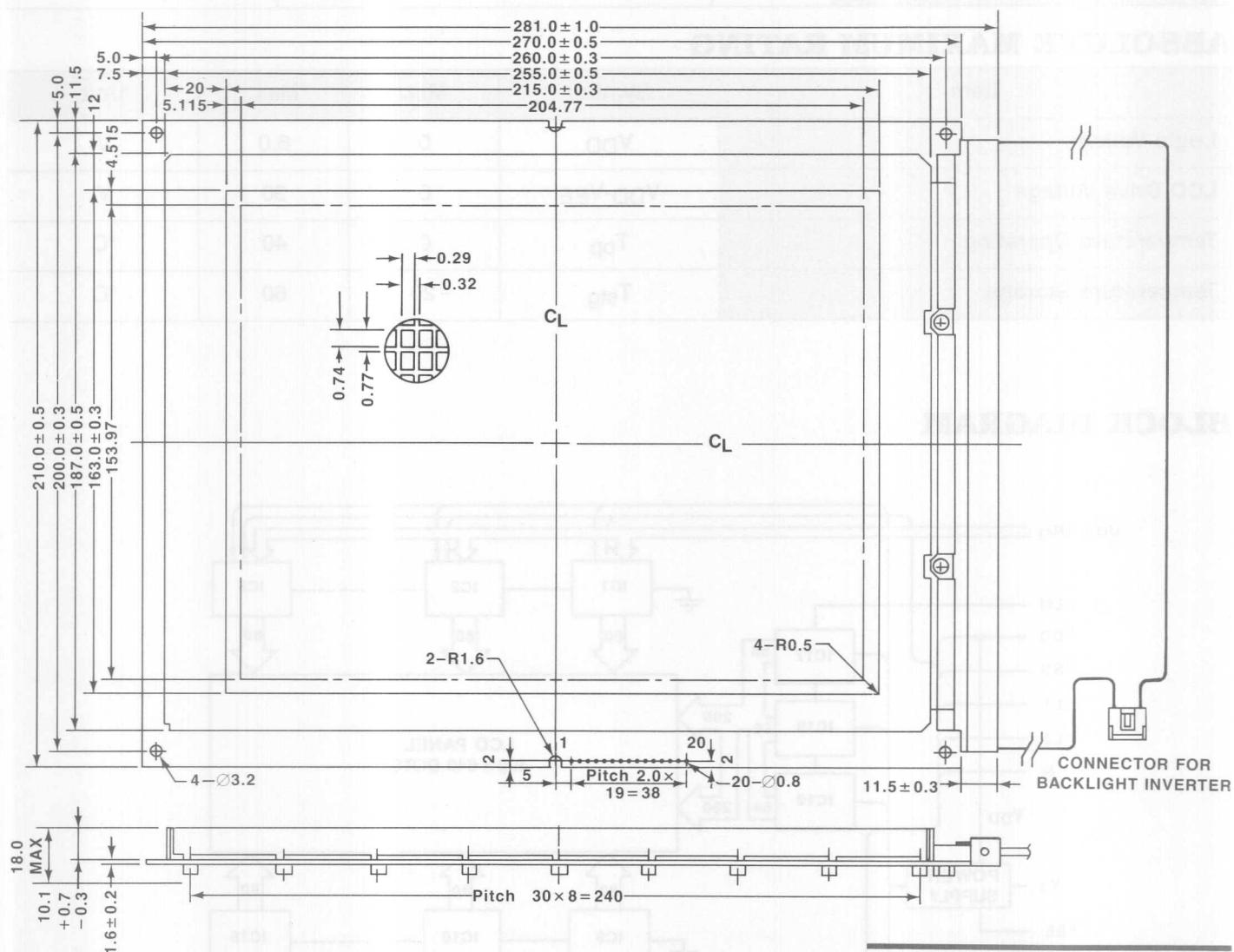


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker signal indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	NC	—
6	D ₀	Data H...Dot on, L...Dot off
7	D ₁	Data H...Dot on, L...Dot off
8	D ₂	Data H...Dot on, L...Dot off
9	D ₃	Data H...Dot on, L...Dot off

Pin No.	Symbol	Function
10	NC	—
11	NC	—
12	NC	—
13	NC	—
14	V _{DD}	+5V
15	V _{SS}	Ground
16	V _{EE}	Power supply for LC drivers
17	V ₀	Operating voltage for LC drivers
18	DISP OFF	H...Display on, L...Display off
19	NC	—
20	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-B or PCX10 Series.

DC DENSITRON CORPORATION

MODEL LM213X400G640DSX

400 Line × 640 Column

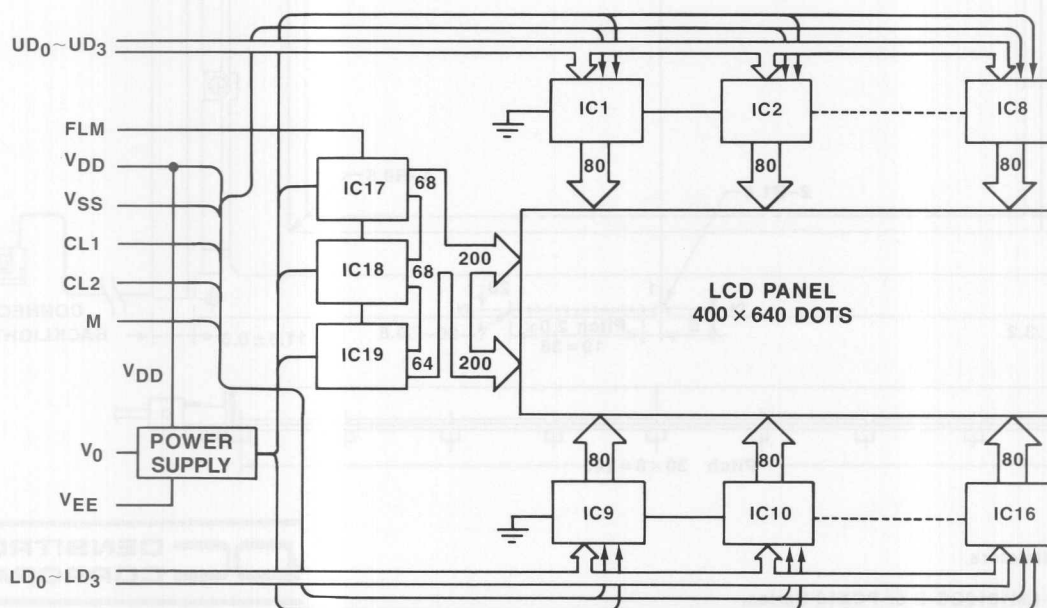
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}	—	-21.0	-22.0	-23.0	V
Current Consumption	I_{DD}	$f_{CL2} = 2.3\text{MHz}$ $UD_0 \sim UD_3 = \text{GND}$ $LD_0 \sim LD_3 = \text{GND}$	—	7.5	—	mA
	I_{EE}		—	5.0	—	mA
Clock Frequency	f_{CL2}	—	2.24	2.3	2.40	MHz
LC Drive Voltage (1/200 duty cycle)	$V_{DD} - V_0$	Temp = 0°C	—	26.0	—	V
		Temp = 25°C	—	23.7	—	V
		Temp = 40°C	—	22.4	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD}	0	6.0	V
LCD Drive Voltage	$V_{DD} - V_{EE}$	0	30	V
Temperature-Operating	T_{op}	0	40	°C
Temperature-Storage	T_{stg}	-20	60	°C

BLOCK DIAGRAM

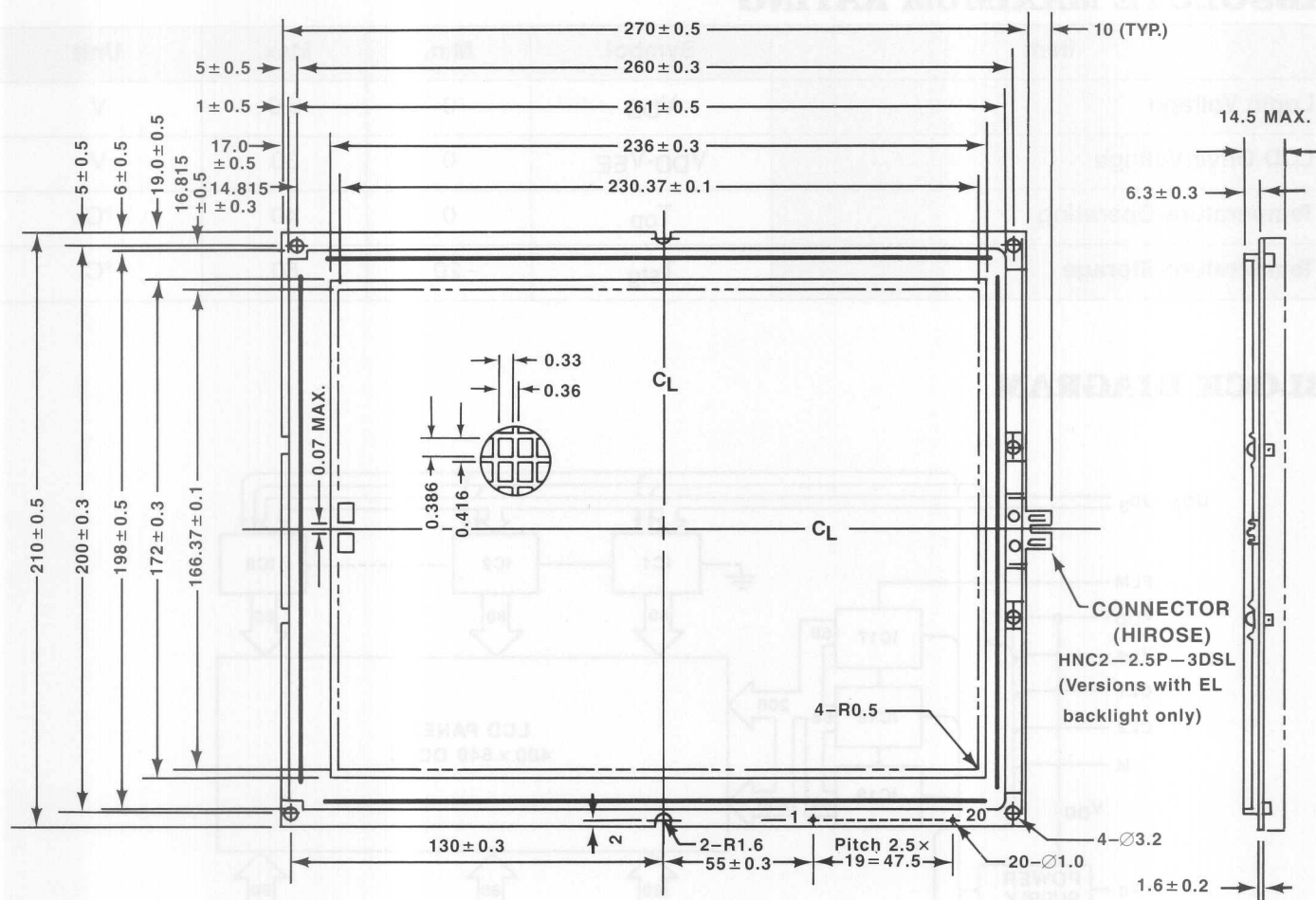


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	NC	_____
6	UD ₀	Upper half data H...Dot on, L...Dot off
7	UD ₁	Upper half data H...Dot on, L...Dot off
8	UD ₂	Upper half data H...Dot on, L...Dot off
9	UD ₃	Upper half data H...Dot on, L...Dot off

Pin No.	Symbol	Function
10	LD ₀	Lower half data H...Dot on, L...Dot off
11	LD ₁	Lower half data H...Dot on, L...Dot off
12	LD ₂	Lower half data H...Dot on, L...Dot off
13	LD ₃	Lower half data H...Dot on, L...Dot off
14	V _{DD}	+5V
15	V _{SS}	Ground
16	V _{EE}	Power supply for LC drivers
17	V ₀	Operating voltage for LC drivers
18	DISP OFF	H... Display on, L...Display off
19	NC	_____
20	NC	_____

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-G, PCX10 Series or SPX20 Series.



**DENSITRON
CORPORATION**

MODEL LM218X400G640DSX

400 Line × 640 Column

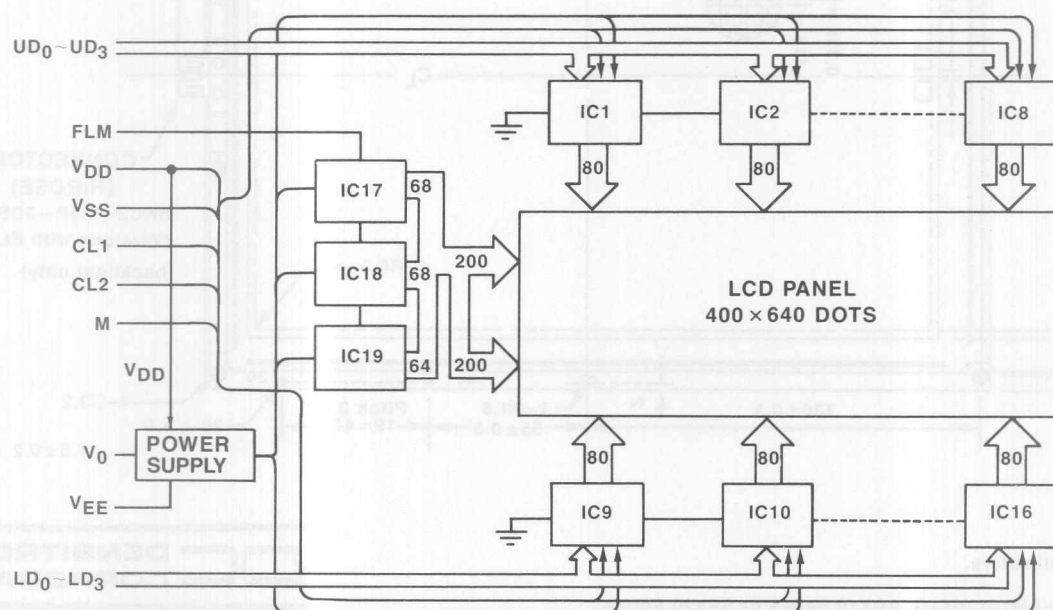
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-21.0	-22.0	-23.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.30MHz UD ₀ ~UD ₃ = GND	—	6.5	—	mA
	I _{EE}	LD ₀ ~LD ₃ = GND	—	5.0	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.30	2.40	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD} -V ₀	Temp = 0°C	—	24.3	—	V
		Temp = 25°C	—	22.3	—	V
		Temp = 40°C	—	20.3	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	30	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

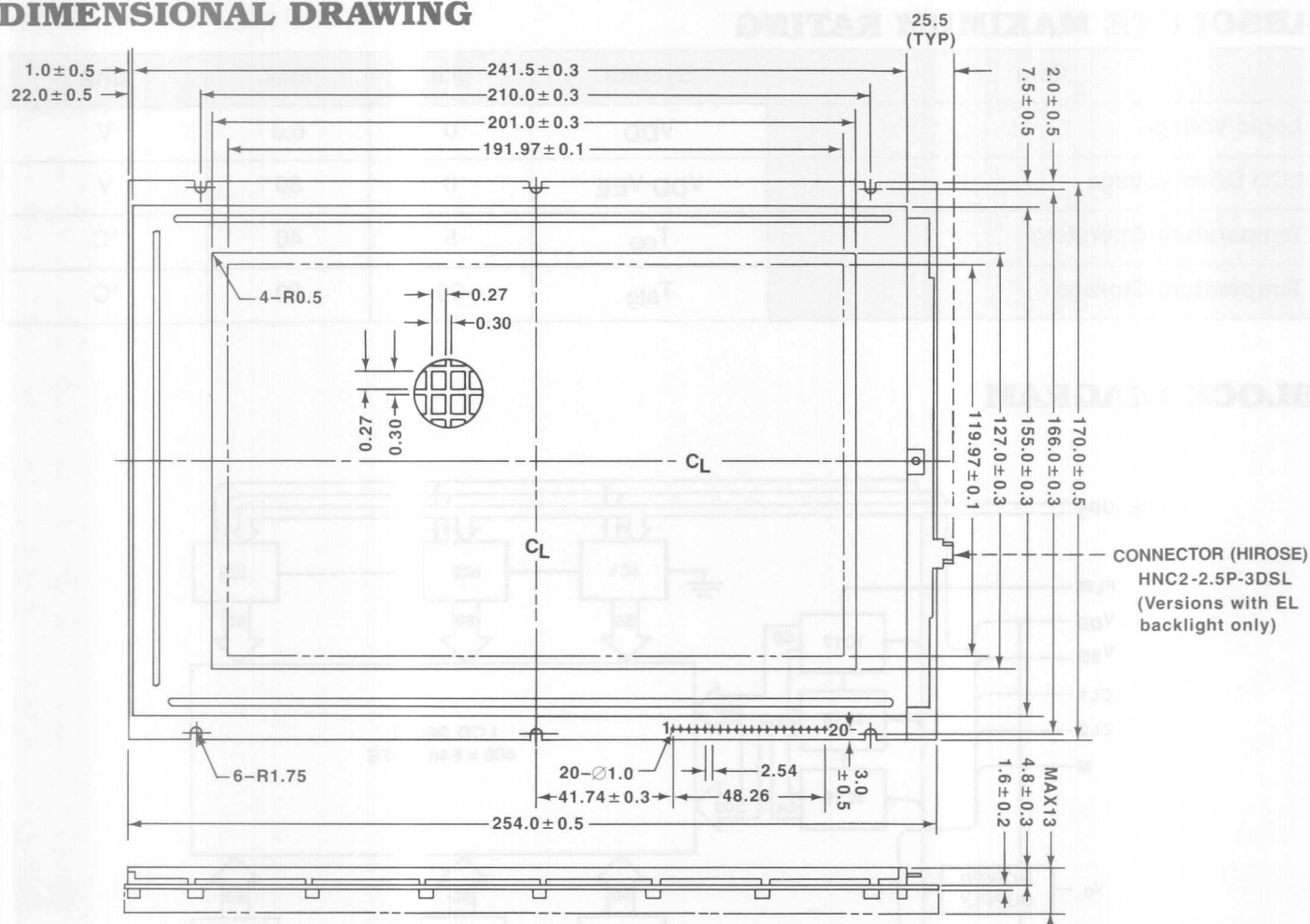
BLOCK DIAGRAM



CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle	10	LD ₀	Lower half data H...Dot on, L...Dot off
2	M	Control signal for AC drive	11	LD ₁	Lower half data H...Dot on, L...Dot off
3	CL1	The CL1 latches the serial data in the shift registers	12	LD ₂	Lower half data H...Dot on, L...Dot off
4	CL2	Clock signal for shifting the serial data	13	LD ₃	Lower half data H...Dot on, L...Dot off
5	NC	_____	14	V _{DD}	+ 5V
6	UD ₀	Upper half data H...Dot on, L...Dot off	15	V _{SS}	Ground
7	UD ₁	Upper half data H...Dot on, L...Dot off	16	V _{EE}	Power supply for LC drivers
8	UD ₂	Upper half data H...Dot on, L...Dot off	17	V ₀	Operating voltage for LC drivers
9	UD ₃	Upper half data H...Dot on, L...Dot off	18	DISP OFF	H... Display on, L...Display off
			19	NC	_____
			20	NC	_____

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-G, PCX10 Series or SPX20 Series.

MODEL LM638E400G640DSB

400 Line × 640 Column

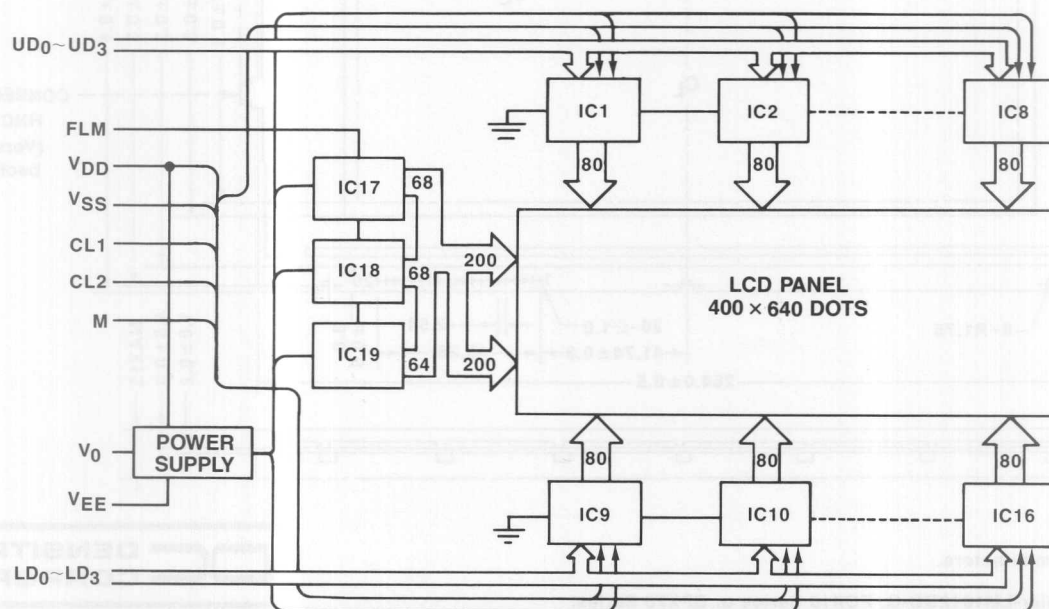
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-21.0	-22.0	-23.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.32MHz UD ₀ ~UD ₃ = GND	—	7.5	—	mA
	I _{EE}	LD ₀ ~LD ₃ = GND	—	5.0	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.32	2.4	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD} - V ₀	Temp = 5°C	—	27.0	—	V
		Temp = 25°C	—	25.5	—	V
		Temp = 40°C	—	24.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	30	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

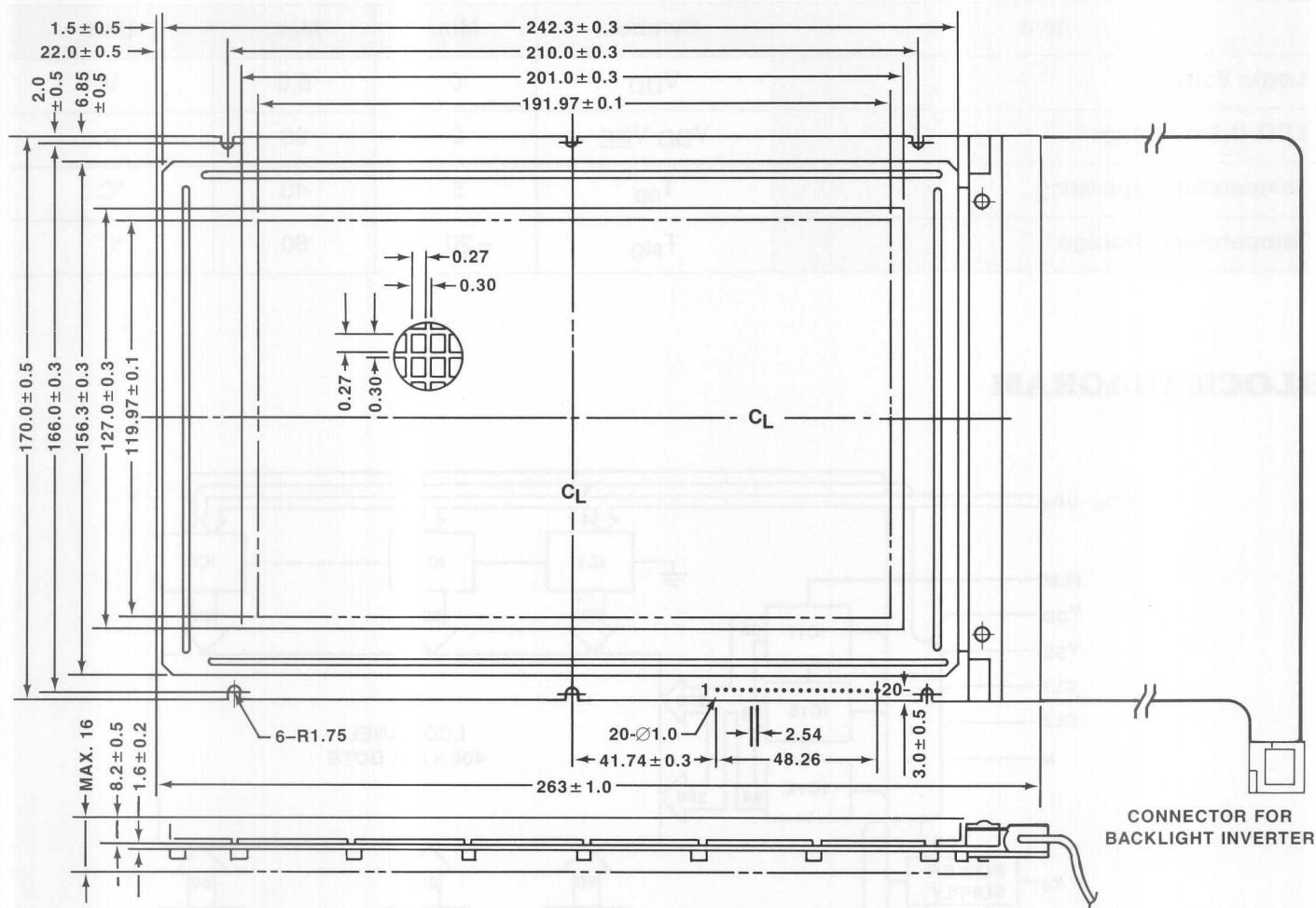


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	The FLM signal indicates the beginning of each display cycle
2	M	Control signal for AC driving
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	NC	—
6	UD ₀	Upper half data H...Dot on, L...Dot off
7	UD ₁	Upper half data H...Dot on, L...Dot off
8	UD ₂	Upper half data H...Dot on, L...Dot off
9	UD ₃	Upper half data H...Dot on, L...Dot off

Pin No.	Symbol	Function
10	LD ₀	Lower half data H...Dot on, L...Dot off
11	LD ₁	Lower half data H...Dot on, L...Dot off
12	LD ₂	Lower half data H...Dot on, L...Dot off
13	LD ₃	Lower half data H...Dot on, L...Dot off
14	V _{DD}	+5V
15	V _{SS}	Ground
16	V _{EE}	Power supply for LC drivers
17	V ₀	Operating voltage for LC driving
18	DISP OFF	H...Display on, L...Display off
19	NC	————
20	NC	————

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-G, PCX10 Series or SPX20 Series.

MODEL LM643E400G640DSB

400 Line × 640 Column

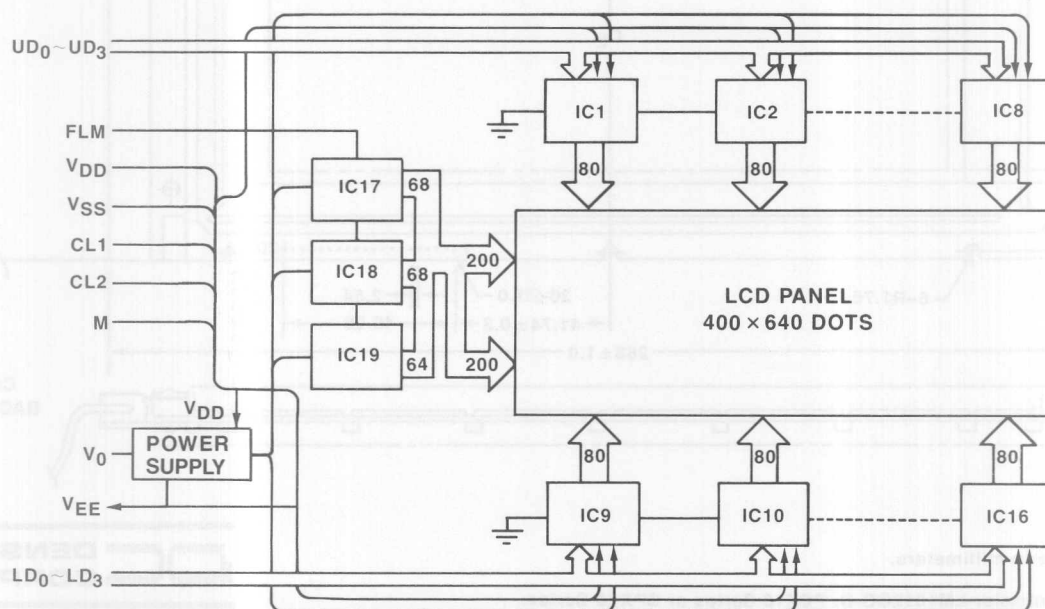
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	−21.0	−22.0	−23.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.30MHz UD ₀ ~UD ₃ = GND	—	7.5	—	mA
	I _{EE}	LD ₀ ~LD ₃ = GND	—	5.0	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.30	2.40	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD} -V ₀	Temp = 5°C	—	27.0	—	V
		Temp = 25°C	—	25.5	—	V
		Temp = 40°C	—	24.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	30	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	−20	60	°C

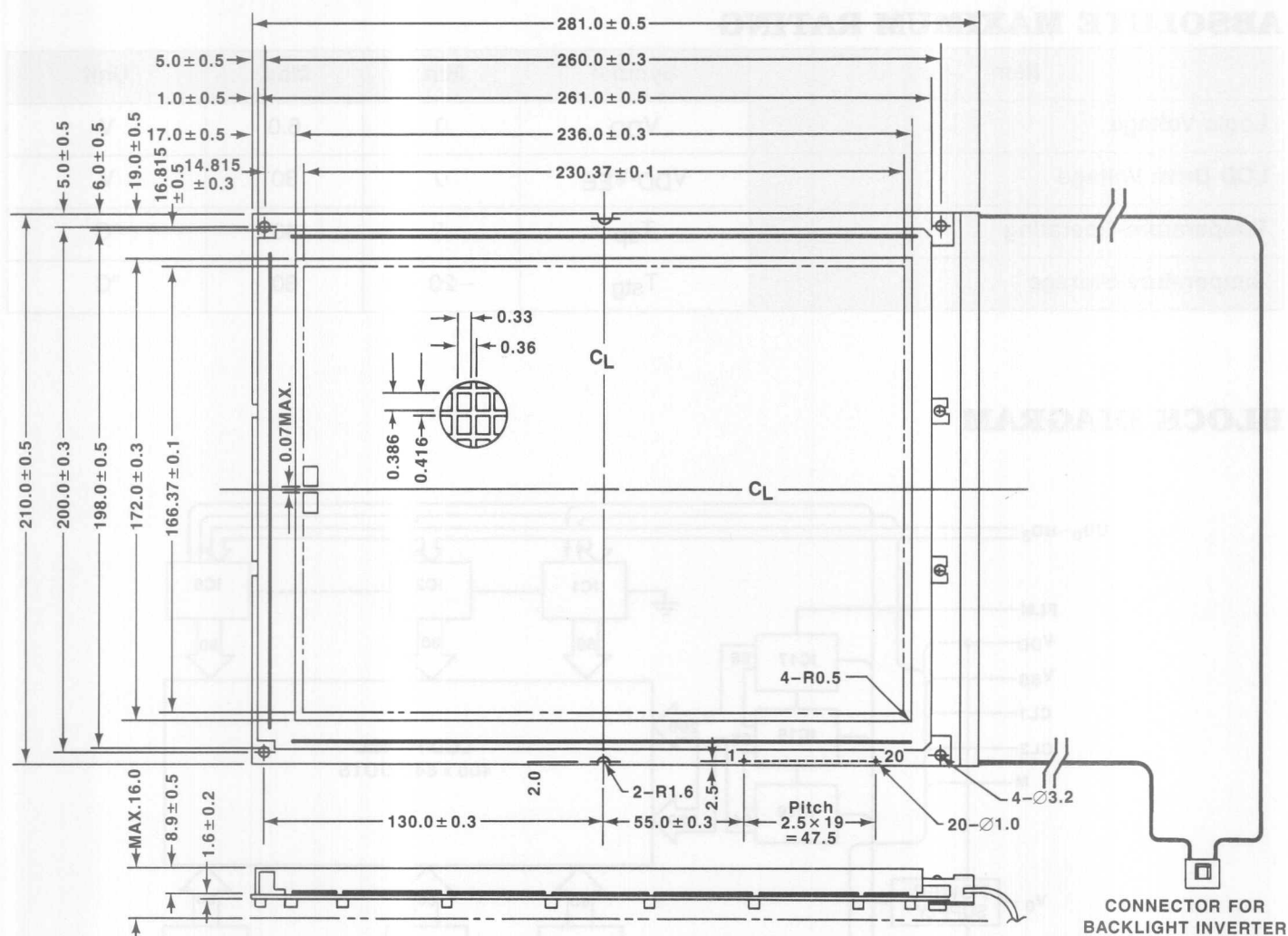
BLOCK DIAGRAM



CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle	10	LD ₀	Lower half data H...Dot on, L...Dot off
2	M	Control signal for AC drive	11	LD ₁	Lower half data H...Dot on, L...Dot off
3	CL1	The CL1 latches the serial data in the shift registers	12	LD ₂	Lower half data H...Dot on, L...Dot off
4	CL2	Clock signal for shifting the serial data	13	LD ₃	Lower half data H...Dot on, L...Dot off
5	NC	_____	14	V _{DD}	+ 5V
6	UD ₀	Upper half data H...Dot on, L...Dot off	15	V _{SS}	Ground
7	UD ₁	Upper half data H...Dot on, L...Dot off	16	V _{EE}	Power Supply for LC drivers
8	UD ₂	Upper half data H...Dot on, L...Dot off	17	V ₀	Operating voltage for LC drivers
9	UD ₃	Upper half data H...Dot on, L...Dot off	18	DISP OFF	H... Display on, L... Display off
			19	NC	_____
			20	NC	_____

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-G, PCX10 Series or SPX20 Series.

**DENSITRON
CORPORATION**

MODEL LM858E400G640DSW

400 Line × 640 Column

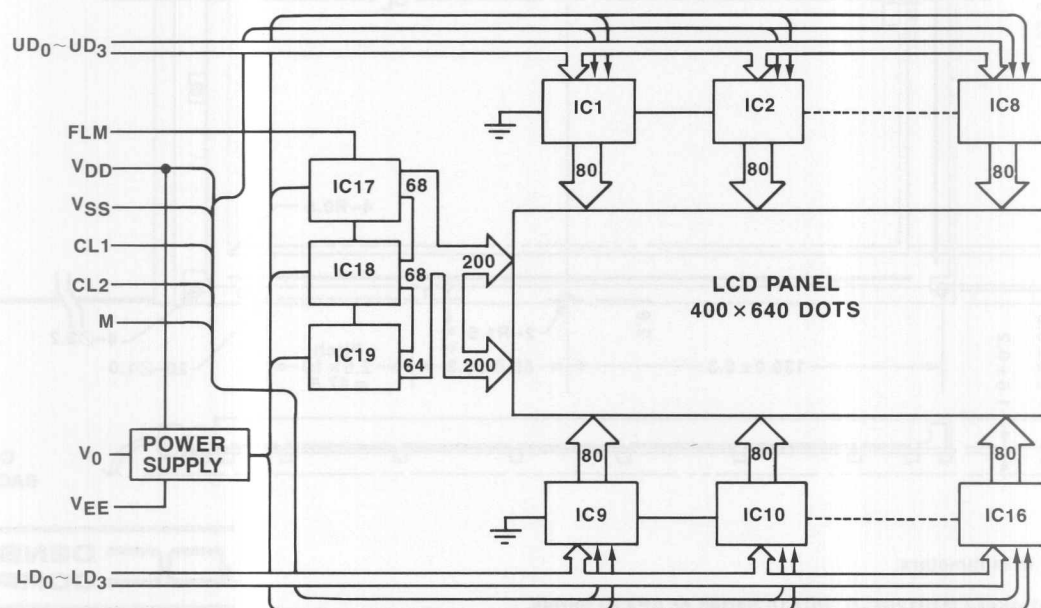
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}	—	-22.0	-23.0	-24.0	V
Current Consumption	I_{DD}	$f_{CL2} = 2.32\text{MHz}$ $UD_0 \sim UD_3 = \text{GND}$	—	7.5	—	mA
	I_{EE}	$LD_0 \sim LD_3 = \text{GND}$	—	5.0	—	mA
Clock Frequency	f_{CL2}	—	2.24	2.32	2.40	MHz
LC Drive Voltage (1/200 duty cycle)	V_{DD-V_0}	Temp = 5°C	—	27.0	—	V
		Temp = 25°C	—	25.5	—	V
		Temp = 40°C	—	24.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD}	0	6.0	V
LCD Drive Voltage	$V_{DD-V_{EE}}$	0	30	V
Temperature-Operating	T_{op}	5	40	°C
Temperature-Storage	T_{stg}	-20	60	°C

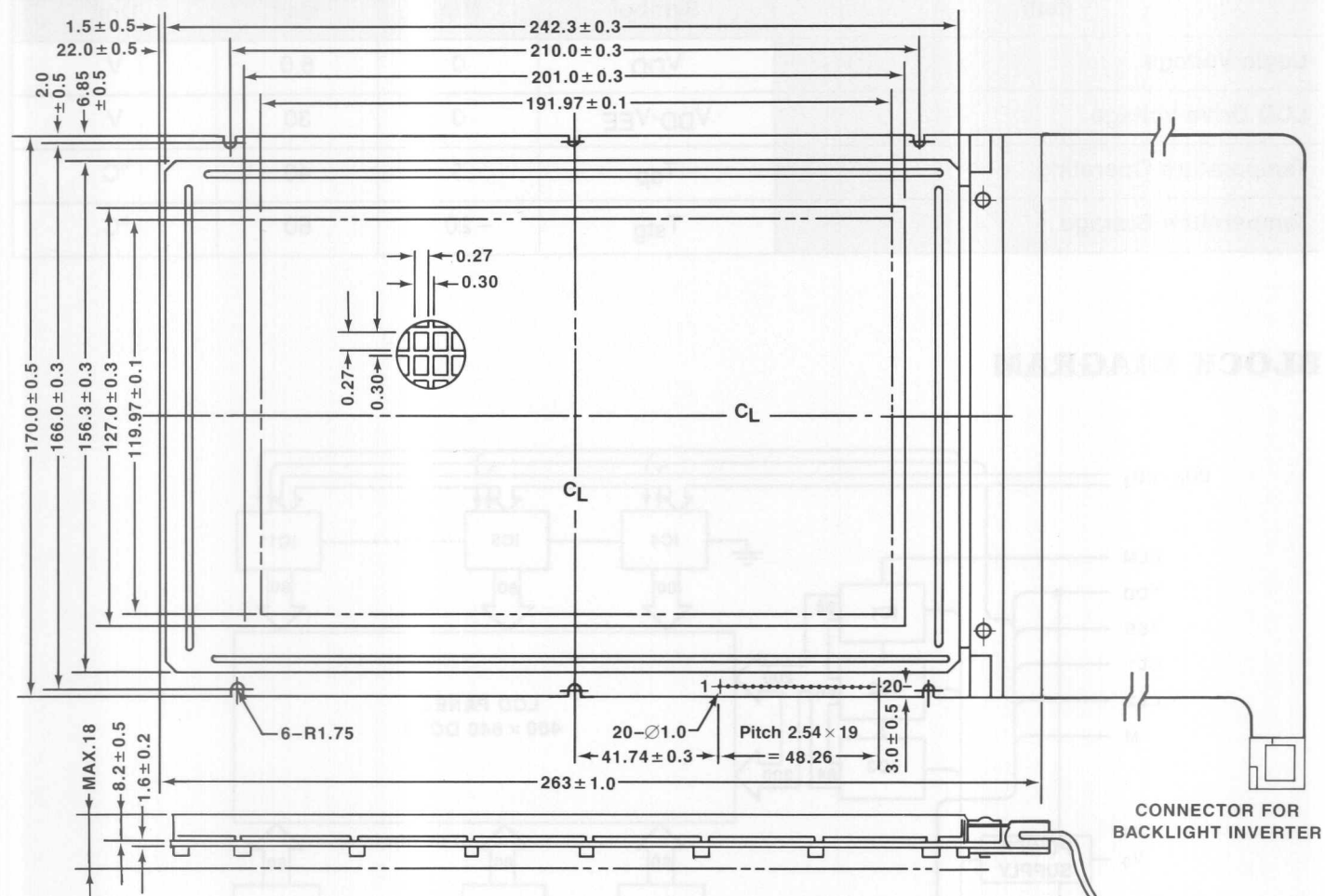
BLOCK DIAGRAM



CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle	10	LD ₀	Lower half data H...Dot on, L...Dot off
2	M	Control signal for AC drive	11	LD ₁	Lower half data H...Dot on, L...Dot off
3	CL1	The CL1 latches the serial data in the shift registers	12	LD ₂	Lower half data H...Dot on, L...Dot off
4	CL2	Clock signal for shifting the serial data	13	LD ₃	Lower half data H...Dot on, L...Dot off
5	NC	_____	14	V _{DD}	+5V
6	UD ₀	Upper half data H...Dot on, L...Dot off	15	V _{SS}	Ground
7	UD ₁	Upper half data H...Dot on, L...Dot off	16	V _{EE}	Power supply for LC drivers
8	UD ₂	Upper half data H...Dot on, L...Dot off	17	V ₀	Operating voltage for LC drivers
9	UD ₃	Upper half data H...Dot on, L...Dot off	18	DISP OFF	H...Display on, L...Display off
			19	NC	_____
			20	NC	_____

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-G, PCX10 Series or SPX20 Series.

**DENSITRON
CORPORATION**

MODEL LM853E400G640DSW

400 Line × 640 Column

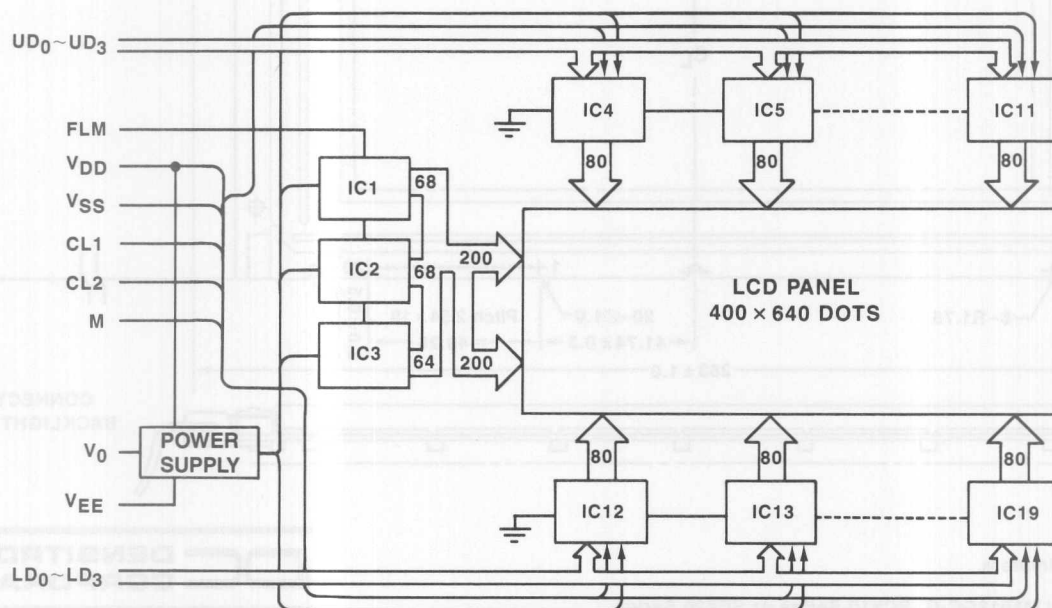
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.75	V
LCD Drive Voltage	V _{EE}	—	-22.0	-23.0	-24.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.30MHz UD ₀ ~UD ₃ = GND	—	7.5	—	mA
	I _{EE}	LD ₀ ~LD ₃ = GND	—	5.0	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.30	2.40	MHz
LC Drive Voltage (1/200 duty cycle)	V _{DD} -V ₀	Temp = 5°C	—	27.0	—	V
		Temp = 25°C	—	25.5	—	V
		Temp = 40°C	—	24.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	6.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	30	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

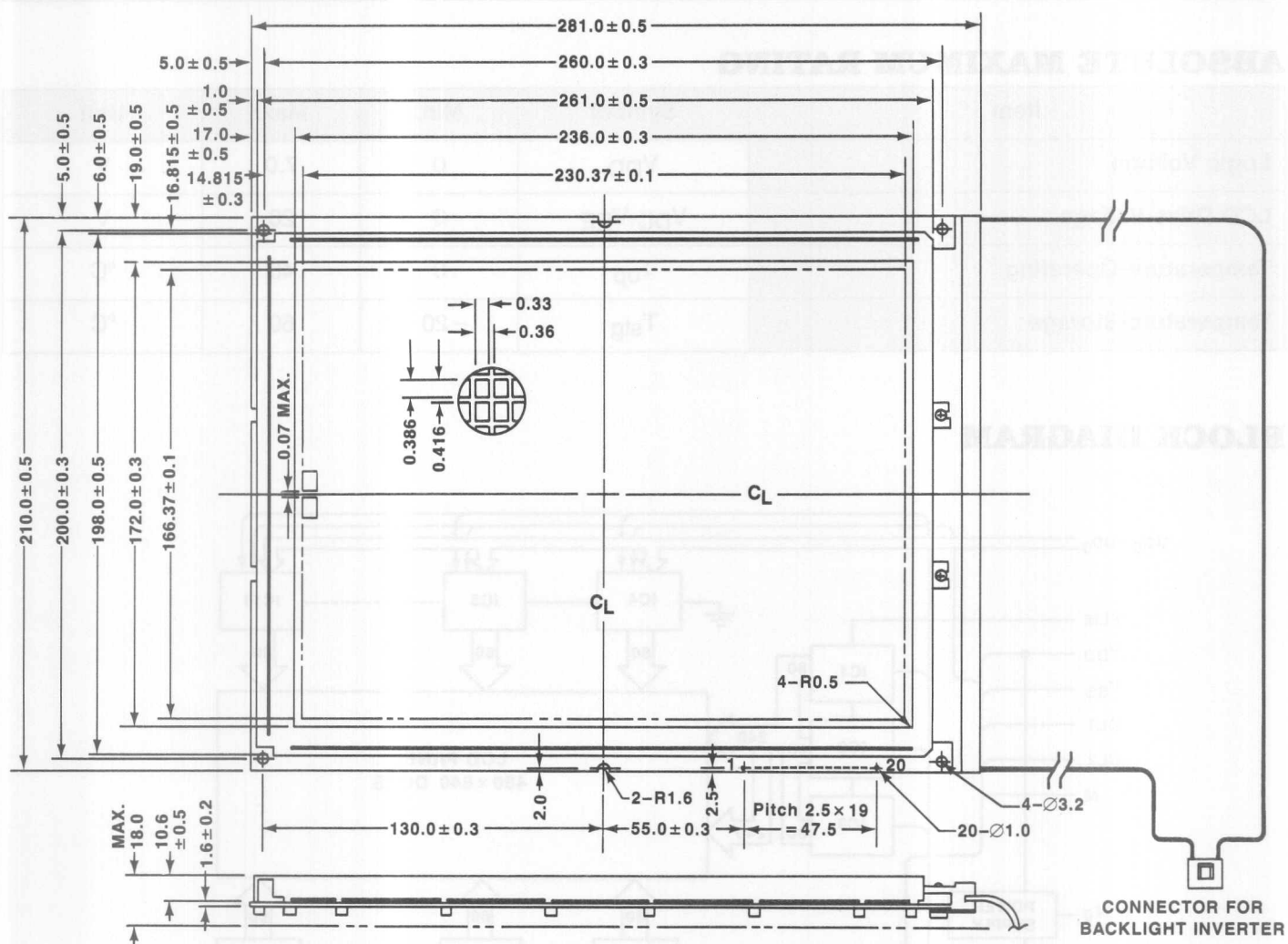


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker signal indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	NC	—
6	UD0	Upper half data H...Dot on, L...Dot off
7	UD1	Upper half data H...Dot on, L...Dot off
8	UD2	Upper half data H...Dot on, L...Dot off
9	UD3	Upper half data H...Dot on, L...Dot off

Pin No.	Symbol	Function
10	LD0	Lower half data H...Dot on, L...Dot off
11	LD1	Lower half data H...Dot on, L...Dot off
12	LD2	Lower half data H...Dot on, L...Dot off
13	LD3	Lower half data H...Dot on, L...Dot off
14	VDD	+5V
15	VSS	Ground
16	VEE	Power supply for LC drivers
17	V ₀	Operating voltage for LC drivers
18	DISP OFF	H...Display on, L...Display off
19	NC	—
20	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-LM1012GC-G, PCX10 Series or SPX20 Series.

DC DENSITRON CORPORATION

MODEL LM237X480G640DSX

480 Line × 640 Column

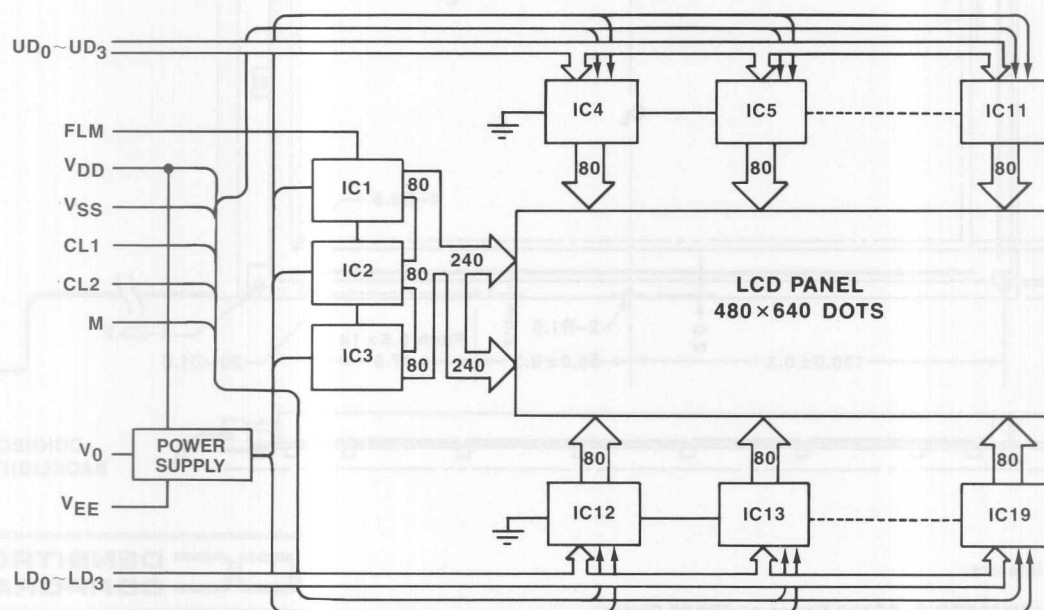
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	-21.0	-22.0	-23.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.88MHz UD ₀ ~UD ₃ = LOW	—	7.5	—	mA
	I _{EE}	LD ₀ ~LD ₃ = LOW	—	6.0	—	mA
Clock Frequency	f _{CL2}	—	2.24	2.88	3.5	MHz
LC Drive Voltage (1/240 duty cycle)	V _{DD} - V ₀	Temp = 0°C	—	26.5	—	V
		Temp = 25°C	—	24.0	—	V
		Temp = 40°C	—	22.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	7.0	V
LCD Drive Voltage	V _{DD} -V _{EE}	0	28	V
Temperature-Operating	T _{op}	0	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

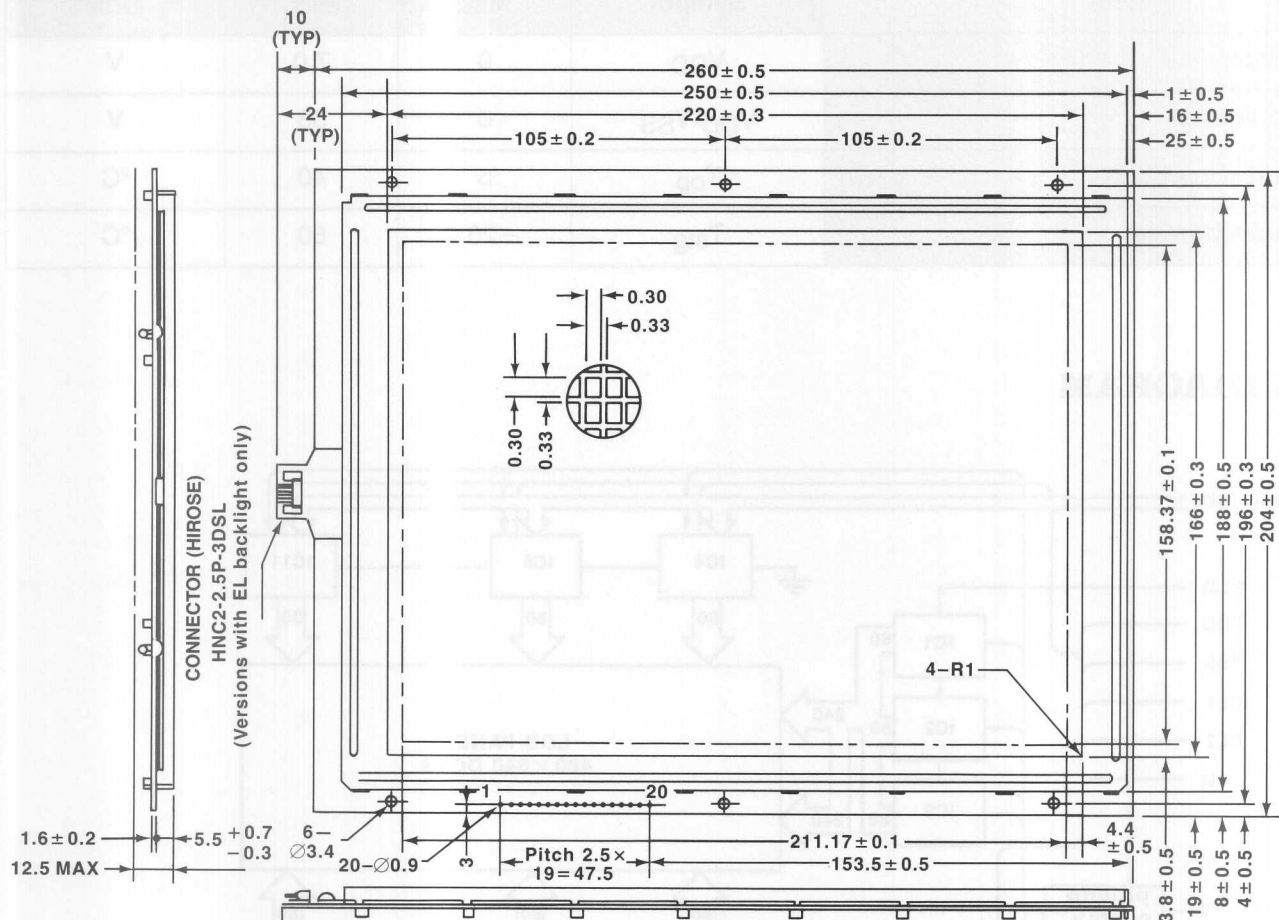
BLOCK DIAGRAM



CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle	10	LD ₀	Lower half data H...Dot on, L...Dot off
2	M	Control signal for AC drive	11	LD ₁	Lower half data H...Dot on, L...Dot off
3	CL1	The CL1 latches the serial data in the shift registers	12	LD ₂	Lower half data H...Dot on, L...Dot off
4	CL2	Clock signal for shifting the serial data	13	LD ₃	Lower half data H...Dot on, L...Dot off
5	NC	—	14	V _{DD}	+5V
6	UD ₀	Upper half data H...Dot on, L...Dot off	15	V _{SS}	Ground
7	UD ₁	Upper half data H...Dot on, L...Dot off	16	V _{EE}	Power supply for LC drivers
8	UD ₂	Upper half data H...Dot on, L...Dot off	17	V ₀	Operating voltage for LC drivers
9	UD ₃	Upper half data H...Dot on, L...Dot off	18	NC	—
			19	NC	—
			20	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-PCX10 Series.

DC DENSITRON CORPORATION

MODEL LM674E480G640DSB

480 Line × 640 Column

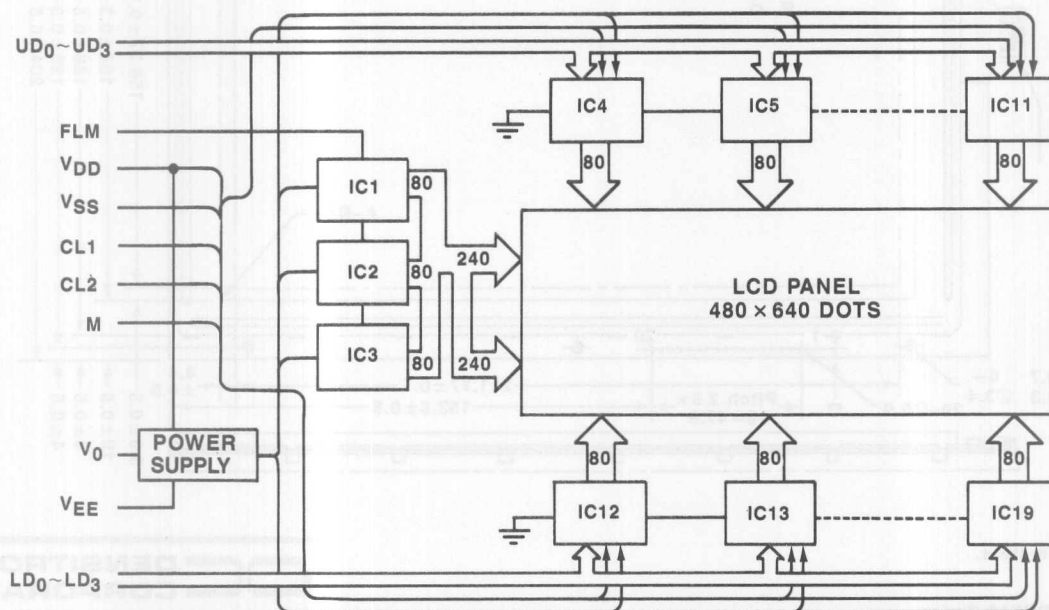
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	+32.0	+35.0	+38.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.88MHz UD ₀ ~UD ₃ = LOW	—	4.0	20	mA
	I _{EE}	LD ₀ ~LD ₃ = LOW	—	15.0	50	mA
Clock Frequency	f _{CL2}	—	2.69	2.88	3.5	MHz
LC Drive Voltage (1/240 duty cycle)	V _{DD} -V ₀	Temp = 5°C	—	33.0	—	V
		Temp = 25°C	—	30.0	—	V
		Temp = 40°C	—	27.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	7.0	V
LCD Drive Voltage	V _{DD} -V _{SS}	0	38	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

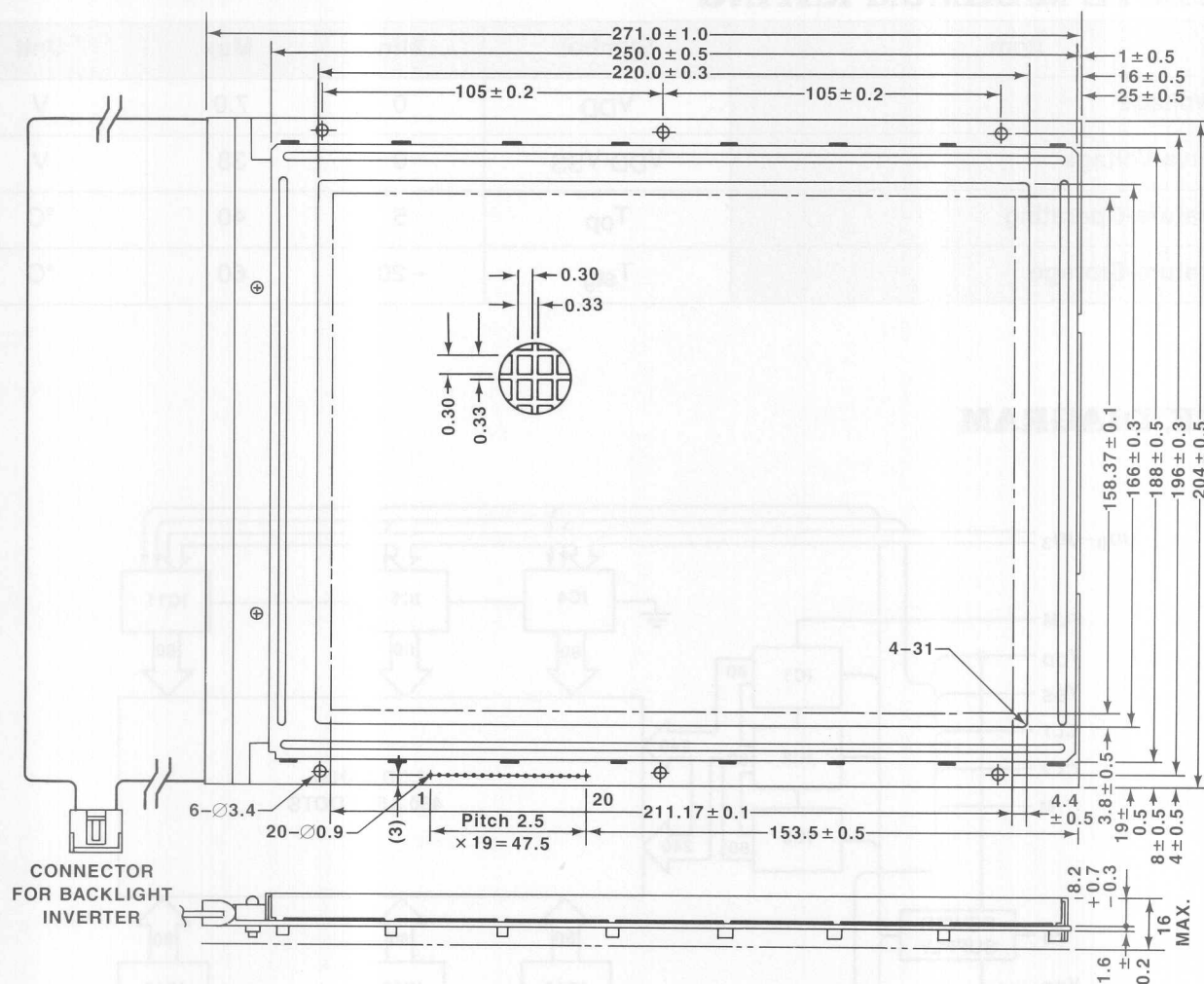
BLOCK DIAGRAM



CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle	10	LD ₀	Lower half data H... Dot on, L...Dot off
2	M	Control signal for AC drive	11	LD ₁	Lower half data H... Dot on, L...Dot off
3	CL1	The CL1 latches the serial data in the shift registers	12	LD ₂	Lower half data H... Dot on, L...Dot off
4	CL2	Clock signal for shifting the serial data	13	LD ₃	Lower half data H... Dot on, L...Dot off
5	NC	—	14	V _{DD}	+5V
6	UD ₀	Upper half data H... Dot on, L...Dot off	15	V _{SS}	Ground
7	UD ₁	Upper half data H... Dot on, L...Dot off	16	V _{EE}	Power supply for LC drivers
8	UD ₂	Upper half data H... Dot on, L...Dot off	17	V ₀	Operating voltage for LC drivers
9	UD ₃	Upper half data H... Dot on, L...Dot off	18	NC	—
			19	NC	—
			20	NC	—

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-Consult factory.

DC DENSITRON CORPORATION

MODEL LM875E480G640DSW

480 Line × 640 Column

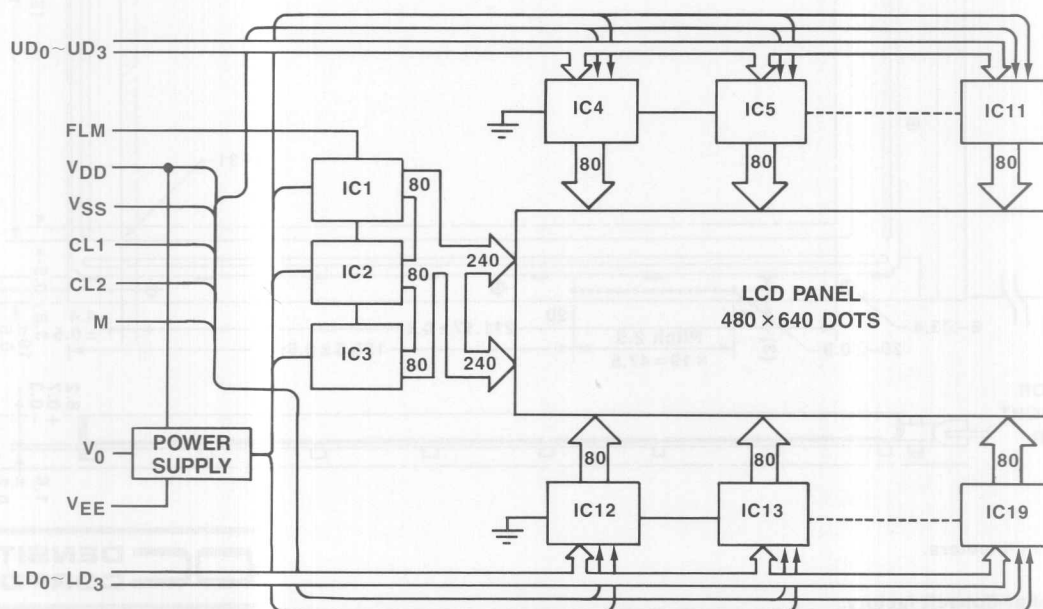
ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	—	4.75	5.0	5.25	V
LCD Drive Voltage	V _{EE}	—	32.0	35.0	38.0	V
Current Consumption	I _{DD}	f _{CL2} = 2.88MHz UD ₀ ~UD ₃ = LOW	—	4.0	20	mA
	I _{EE}	LD ₀ ~LD ₃ = LOW	—	15.0	5.0	mA
Clock Frequency	f _{CL2}	—	2.69	2.88	3.5	MHz
LC Drive Voltage (1/240 duty cycle)	V _{DD} - V ₀	Temp = 5°C	—	33.0	—	V
		Temp = 25°C	—	30.0	—	V
		Temp = 40°C	—	27.5	—	V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V _{DD}	0	7.0	V
LCD Drive Voltage	V _{DD} -V _{SS}	0	38	V
Temperature-Operating	T _{op}	5	40	°C
Temperature-Storage	T _{stg}	-20	60	°C

BLOCK DIAGRAM

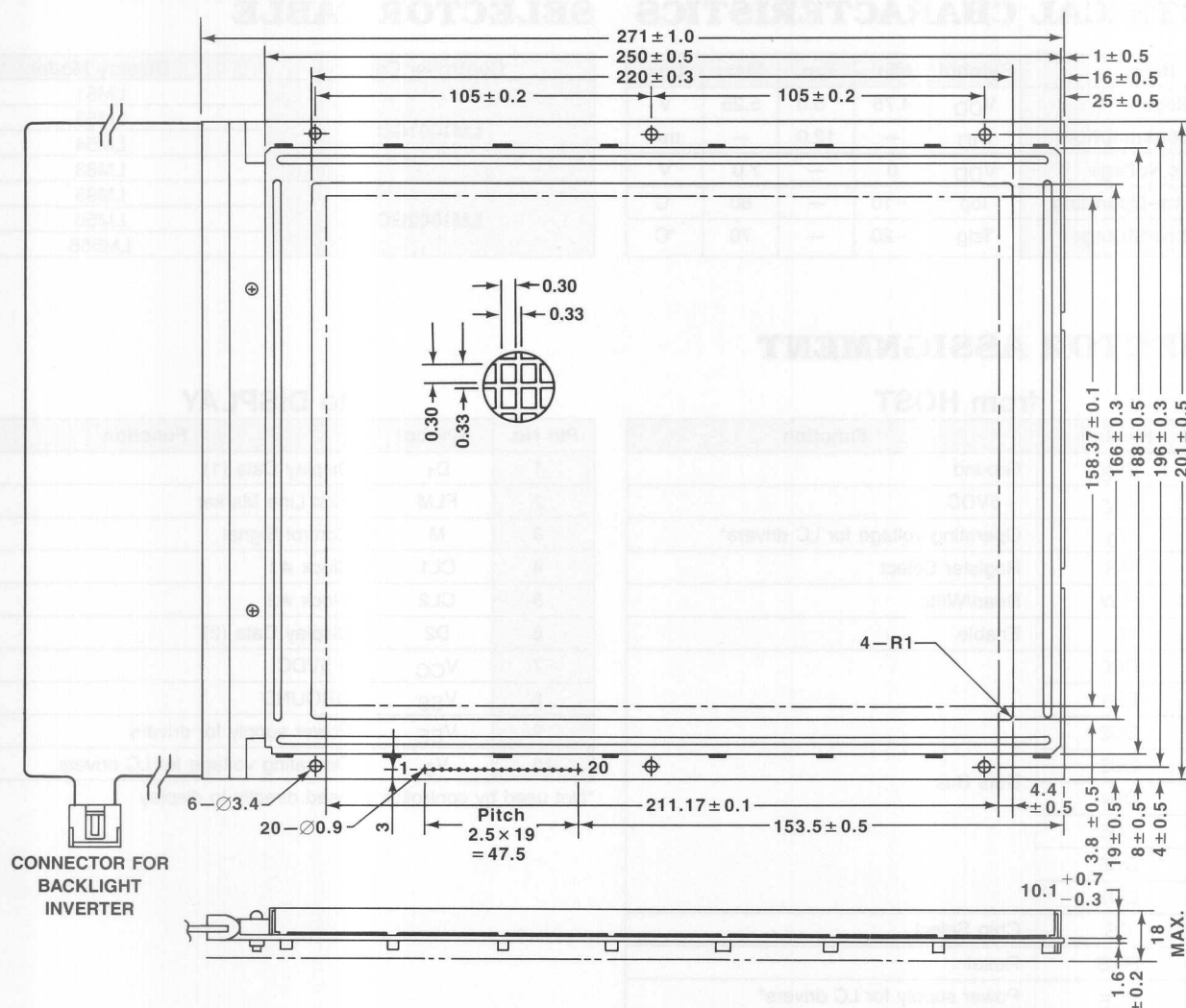


CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker signal indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	NC	_____
6	UD ₀	Upper half data H...Dot on, L...Dot off
7	UD ₁	Upper half data H...Dot on, L...Dot off
8	UD ₂	Upper half data H...Dot on, L...Dot off
9	UD ₃	Upper half data H...Dot on, L...Dot off

Pin No.	Symbol	Function
10	LD ₀	Lower half data H...Dot on, L...Dot off
11	LD ₁	Lower half data H...Dot on, L...Dot off
12	LD ₂	Lower half data H...Dot on, L...Dot off
13	LD ₃	Lower half data H...Dot on, L...Dot off
14	V _{DD}	+5V
15	V _{SS}	Ground
16	V _{EE}	Power supply for LC drivers
17	V ₀	Operating voltage for LC drivers
18	NC	_____
19	NC	_____
20	NC	_____

DIMENSIONAL DRAWING



All dimensions are in millimeters.

Recommended controller-Consult factory.



MODELS LM1001GC/LM1002GC GRAPHIC CONTROLLER CARDS

DESCRIPTION

The LM1001GC and LM1002GC cards are dedicated controllers for Densitron's small graphic LCDs. Both cards contain a microcontroller, display RAM and clock circuitry factory set for the display it is to drive. The difference in the two versions is the size of the RAM. Select the proper card based upon display size.

The controller card provides all critical timing and data signals to the display. The system CPU need only communicate to the card during initialization and when changing information. The cards are pin-for-pin compatible to Densitron's displays.

An 8-bit data bus interface with 4 control lines facilitates a straight-forward connection to most common micro-processors. It can be initialized to accept data as ASCII characters or in dot-addressed graphic patterns. A 5 × 7 dot character generator (with 1 dot intercharacter spacing) is contained within the microcontroller. An optional ROM socket is provided on the card for a custom character generator. When mated with an SA series RS232 card, serial alphanumeric information can be sent to the displays.

ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Logic Voltage	V _{DD}	4.75	5.0	5.25	V
Current Consumption	I _{DD}	—	12.0	—	mA
Max. Logic Voltage	V _{DD}	0	—	7.0	V
Temperature-Operating	T _{op}	—10	—	60	°C
Temperature-Storage	T _{stg}	—20	—	70	°C

SELECTOR TABLE

Controller Card	Display Model
LM1001GC	LM51
	LM53
	LM54
	LM83
LM1002GC	LM95
	LM56
	LM656

CONNECTOR ASSIGNMENT

from HOST

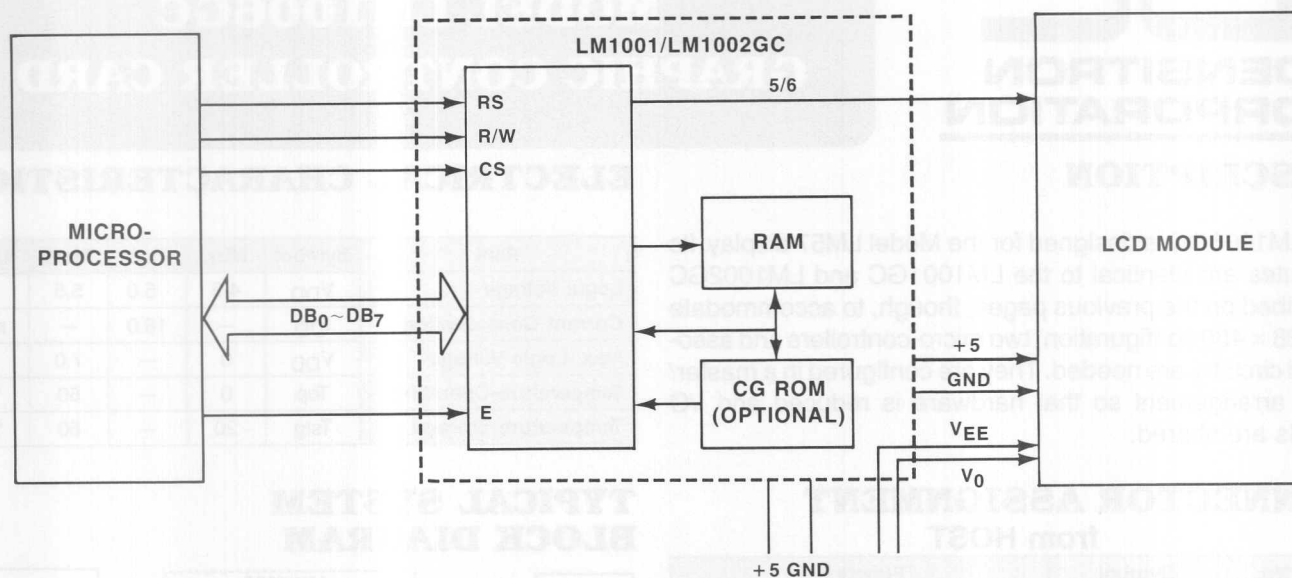
Pin No.	Symbol	Function
1	V _{SS}	Ground
2	V _{CC}	+5VDC
3	V ₀	Operating voltage for LC drivers*
4	RS	Register Select
5	R/W	Read/Write
6	E	Enable
7	DB0	Data Bus
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	\overline{CS}	Chip Select
16	RES	Reset
17	V _{EE}	Power supply for LC drivers*
18	N C	No Connection
19	N C	No Connection
20	N C	No Connection

to DISPLAY

Pin No.	Symbol	Function
1	D ₁	Display Data (1)
2	FLM	First Line Marker
3	M	Control Signal
4	CL1	Clock #1
5	CL2	Clock #2
6	D ₂	Display Data (2)
7	V _{CC}	+5VDC
8	V _{SS}	GROUND
9	V _{EE}	Power supply for drivers
10	V ₀	Operating voltage for LC drivers

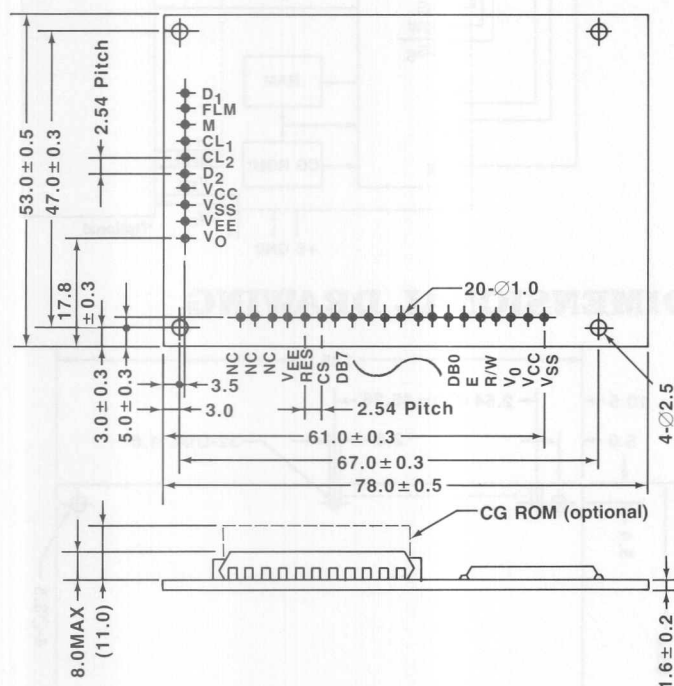
*Not used by controller; passed directly to display

TYPICAL SYSTEM BLOCK DIAGRAM

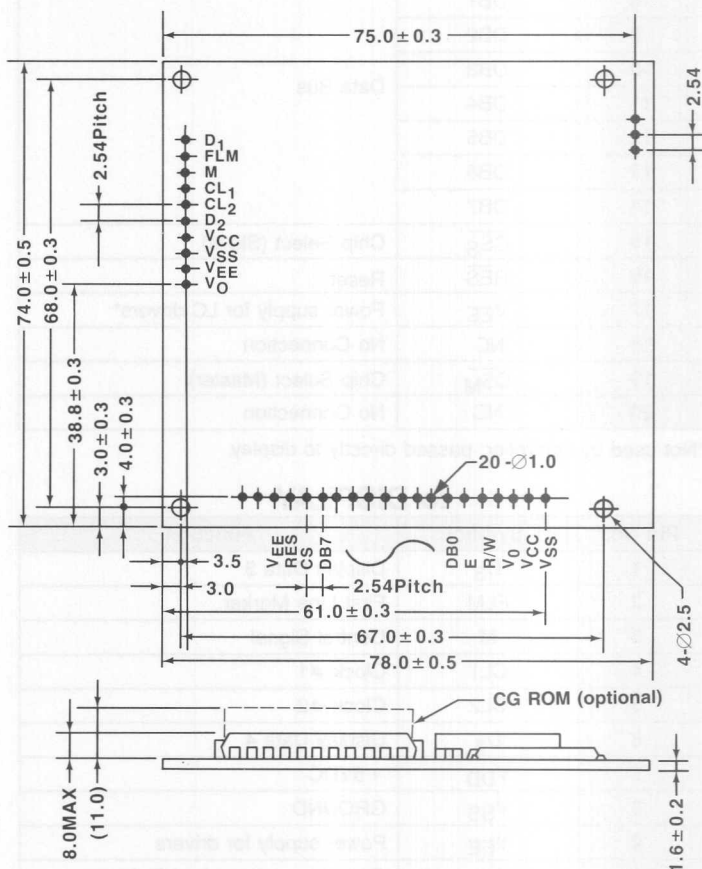


DIMENSIONAL DRAWINGS

LM1001GC



LM1002GC



All dimensions are in millimeters.

MODEL LM1006GC GRAPHIC CONTROLLER CARD

DESCRIPTION

The LM1006GC is designed for the Model LM57 display. Its attributes are identical to the LM1001GC and LM1002GC described on the previous pages, though, to accommodate the 128×480 configuration, two micro-controllers and associated circuitry are needed. They are configured in a master/slave arrangement so that hardware is reduced and I/O signals are shared.

CONNECTOR ASSIGNMENT from HOST

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	+5VDC
3	V_0	Operating voltage for LC drivers*
4	RS	Register Select
5	R/W	Read/Write
6	E	Enable
7	DB0	Data Bus
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	\overline{CS}_S	Chip Select (Slave)
16	\overline{RES}	Reset
17	V_{EE}	Power supply for LC drivers*
18	NC	No Connection
19	\overline{CS}_M	Chip Select (Master)
20	NC	No Connection

*Not used by controller; passed directly to display.

to DISPLAY

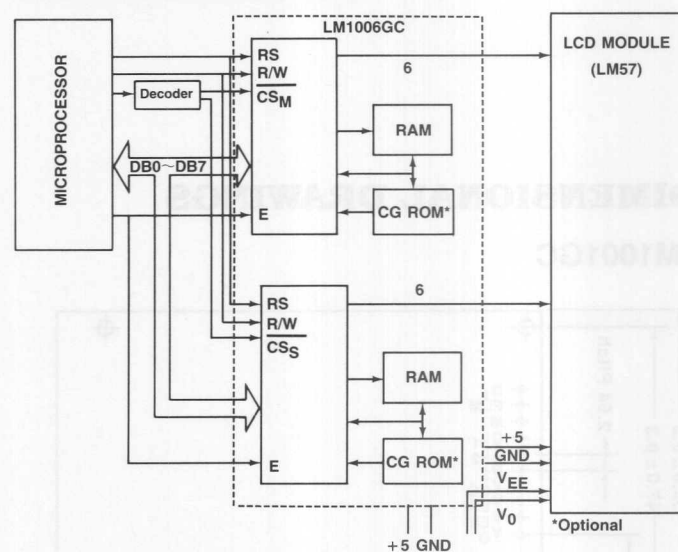
Pin No.	Symbol	Function
1	D_3	Display Data 3
2	FLM	First Line Marker
3	M	Control Signal
4	CL1	Clock #1
5	CL2	Clock #2
6	D_4	Display Data 4
7	V_{DD}	+5VDC
8	V_{SS}	GROUND
9	V_{EE}	Power supply for drivers
10	V_0	Operating voltage for LC drivers
11	D_1	Display Data 1
12	D_2	Display Data 2

All dimensions are in millimeters.

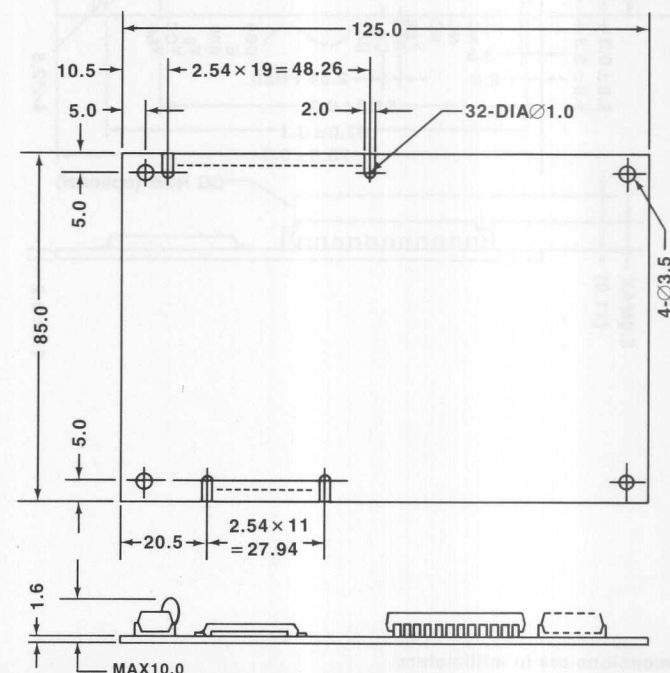
ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	4.5	5.0	5.5	V
Current Consumption	I_{DD}	—	16.0	—	mA
Max. Logic Voltage	V_{DD}	0	—	7.0	V
Temperature-Operating	T_{op}	0	—	50	°C
Temperature-Storage	T_{stg}	-20	—	60	°C

TYPICAL SYSTEM BLOCK DIAGRAM



DIMENSIONAL DRAWING



MODELS LM1012GC-X

GRAPHIC CONTROLLER CARD

GENERAL DESCRIPTION

The LM1012GC-X is an interface card for operating 200×640 and 400×640 graphic LCD panels from an IBM PC/XT/AT or compatible PC using the existing driver card. The card is available for use with either CGA (Color Graphics Adapter) or EGA (Enhanced Graphics Adapter) cards. The version of card ordered should match the resolution of the display. LM1012GC-B is used with 200×640 displays; LM1012GC-G is used with 400×640 displays. (EGA resolution is 350×640. The bottom 50 rows are blanked when using a 400×640 display.)

The LM1012GC-X connects directly to the 9-pin female D socket on the

ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	4.75	5.0	5.25	V
Current Consumption	I_{DD}	TC	TC	TC	mA
Max. Logic Voltage	V_{DD}	-0.3	—	7.0	V
Temperature-Operating	Top	0	—	50	°C
Temperature-Storage	Tstg	-20	—	70	°C

Note: For displays requiring -22 (V_{EE}), a contrast adjustment pot is installed. For displays with other V_{EE} requirements, power is supplied externally via CN3.

CN1 - PC VIDEO INPUT

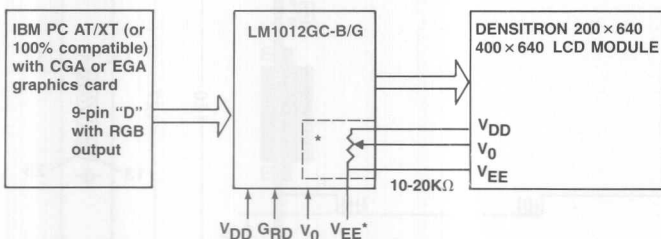
Pin No.	Symbol	I/O	Function
1	GND	P	GND (0V)
3	Rin	I	Display Data
4	Gin	I	"LOGIC OR" for LCD data
5	Bin	I	(data = Rin + Gin + Bin)
6	*CK/ITS	I	Dot Clock or Intensity Data
7	NC	—	No connection
8	H-SYNC	I	Horizontal Sync signal
9	V-SYNC	I	Vertical Sync signal
10	NC	—	No connection

CN3 - POWER SUPPLY INPUT

Pin No.	Symbol	I/O	Function
1	V_{DD}	P	+5V
2	V_{SS}	P	GND (0V)
3	VR1	P	Connect to +5V*
4	VR2	P	Connect to potentiometer 10-20K*
5	VR3	P	External power supply - V_{EE} *

*Used for externally supplied V_{EE} and V_0

TYPICAL SYSTEM BLOCK DIAGRAM



* V_{EE} & V_0 can be provided from the LM1012GC or externally

All dimensions are in millimeters.

back of the CGA and EGA cards. The card receives the RGB video data from the PC and converts the information to signals required by the LCD. Contrast adjustment for the display can be achieved via an on-board potentiometer and V_{EE} supply or by a circuit located externally to the card. Digital switches are provided for fine tuning minor display card differences to the display. The combined package of an LM1012GC-X and Densitron LCD allows the user to locate a flat panel display from a PC up to a typical distance of 1.5 meters.

ELECTRICAL SPECIFICATION

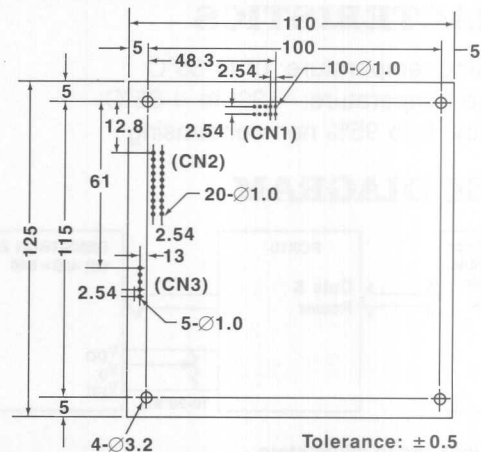
Item	Symbol	Rating Value	Unit
Max. Logic Voltage	V_{DD}	-0.3 to 7.0	V
Temperature-Operating	Top	0 to 50	°C
Temperature-Storage	Tstg	-20 to 70	°C

CN2 - OUTPUT TO LCD

Pin No.	Symbol	I/O	Function
1	FLM	O	First line marker indicates the beginning of each display cycle
2	M	O	Control signal for AC drive
3	CL1	O	CL1 latches the serial data
4	CL2	O	Clock signal for shifting the serial data
5	XECL	O	Clock enable signal for CL2
6	UD0	O	Display Data (Upper side) H = ON L = OFF
7	UD1	O	
8	UD2	O	
9	UD3	O	Display Data (Lower side) H = ON L = OFF
10	LD0	O	
11	LD1	O	
12	LD2	O	
13	LD3	O	
14	V_{DD}	P	+5V connection
15	V_{SS}	P	GND (0V connection)
16	V_{EE}	P	Power supply for LCD drivers
17	V_0	P	Contrast adjustment voltage
18	Disp-off	O	Display-OFF signal H. display on L. display off
19	NC	—	No connection
20	NC	—	No connection

*It must be selected

DIMENSIONAL DRAWING



DESCRIPTION

The PCX10 is an intelligent controller card for operating the 200 × 640 or 400 × 640 graphic LCD panels from an IBM PC/XT/AT or compatible PC. The card replaces the existing CRT graphics controller (CGA* or HGA**) and plugs into any slot within the PC. The PCX10 allows gray scaling capability to support the use of color software. The card is compatible with CGA, MDA or HGA graphics software for all IBM PC applications. An on-board variable negative voltage generator supplies the V_{EE} input to the display (V_0 can be driven from V_{EE} and V_{DD}). Auto-initialization circuitry is provided to initialize the card for each display format and type. 400 × 640 displays show CGA resolution (200 × 640 format) using a double scan technique.

*CGA is a registered trademark of IBM.

**HGA is a registered trademark of Hercules Computer Technology.

FEATURES

- Can be programmed to allow multiple displays to be driven from one PC
- Auto-initialization on power-up
- An on-board variable negative voltage generator to allow a wide range of LCD modules to be driven
- A 69Hz frame refresh rate for a flicker-free display image
- CMOS technology for low power consumption
- Gray scaling to accommodate color application software
- Double-scan mode for 400 × 640 dot LCDs
- 32K × 16-bit wide static RAM for display memory
- A character generator EPROM
- Switch selectable operation mode and character font
- Direct connection to the displays from the 25-pin "D" connector
- Half length card fits standard PC/XT/AT slot

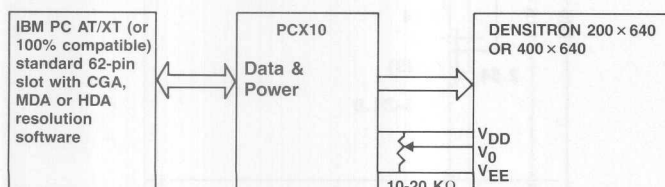
POWER REQUIREMENTS

- Less than 2W

ENVIRONMENTAL CHARACTERISTICS

- Operating temperature: 0° to 55°C
- Storage temperature: -30° to +85°C
- Humidity: 0 to 95% non-condensing

BLOCK DIAGRAM



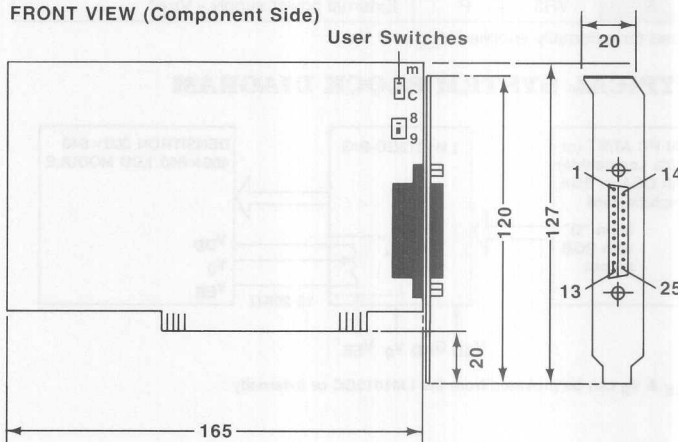
All dimensions are in millimeters.

CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{DD}	+5VDC to display
2	CL2	Clock 2
3	V_{SS}	Ground
4	V_{SS}	Ground
5	UD0	Upper Data 0
6	UD2	Upper Data 2
7	LD0	Lower Data 0
8	LD2	Lower Data 2
9	M	Control signal for AC drive
10	NC	No connection
11	NC	No connection
12	NC	No connection
13	V_{EE}	Power supply for LC drivers
14	Off	Display Off
15	NC	No connection
16	NC	No connection
17	CL1	Clock 1
18	UD1	Upper Data 1
19	UD3	Upper Data 3
20	LD1	Lower Data 1
21	LD3	Lower Data 3
22	E	Enable
23	FLM	First line marker
24	V_{SS}	Ground
25	V_{SS}	Ground

DIMENSIONAL DRAWING

FRONT VIEW (Component Side)



SERIES SPX20 CONTROLLER CARD

DESCRIPTION

The SPX20 operates Densitron's 400 × 640 displays from an RS232 data line. The card is programmed with an EPROM to operate in any number of popular terminals emulations or as a generic serial input controller card. The bi-directional

feature of the SPX20 allows it to accept a keyboard. An additional I/O port is available for connecting a peripheral such as a printer.

DISPLAY FORMAT

- 80 programmable characters per line
- 16 to 40 programmable number of lines
- Jump or Smooth scroll
- Programmable character cell size up to 8 × 16 pixels
- Double height/width characters

VIDEO ATTRIBUTES

- Inverse video
- Blink
- Underline
- Half-bright
- Blank (no display)
- Programmable refresh rate
- Underline, block or disabled
- Flashing or steady
- Combinations of above

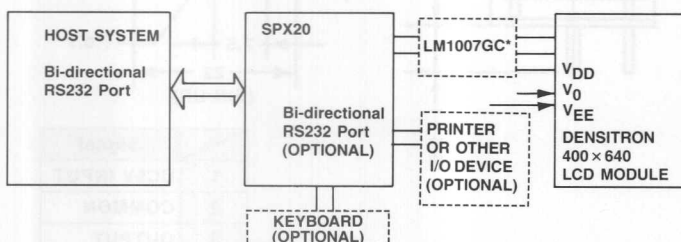
ENVIRONMENTAL CHARACTERISTICS

- Operating temperature: 0° to 70°C
- Storage temperature: -20° to +85°C
- Humidity: 20 to 80% non-condensing

POWER REQUIREMENTS

- 5V @ 2W (typical)

TYPICAL SYSTEM BLOCK DIAGRAM



*LM1007GC CIRCUITRY TO BE INCORPORATED IN FUTURE VERSIONS OF SPX20

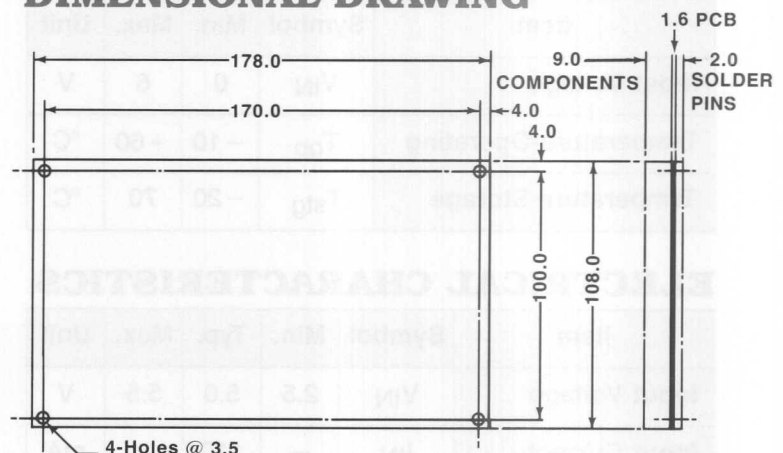
HOST and PRINTER INTERFACE

- Serial asynchronous communication
- EIA RS232C—CCITT V.24/V.28 standard other interface options available
- Separate transmit/receive rates
- 50 to 38,400 Baud, 16 settings (up to 19,200 Baud for printer interface)
- Full duplex, half duplex or local modes
- Standard ASCII codes

TERMINAL EMULATIONS

- Customer emulation via EPROM
- Select from list below:
 1. DEC VT100, VT220, VT320
 2. Datapoint 8220
 3. Syscope Mark IV (Systime)
 4. Wyse 50 + ADM 22
 5. Hewlett Packard HP2622, HP2392
 6. Kimtron/IBM PC KT-7/PC
 7. Honeywell VIP 7200
 8. Tandberg TDU2215
 9. ICL 6402G (no graphics options)
 10. Data General D210/D211
- Custom emulations available

DIMENSIONAL DRAWING



All dimensions are in millimeters.

BACKLIGHT INVERTERS FOR GRAPHIC LCD MODULES

RECOMMENDED INVERTER FOR BACKLIT DISPLAYS

for EL BACKLIGHT		
MODEL NUMBER	B & F POLARIZER	E POLARIZER
LM51	DAS5V7	DAS5V7
LM53	DAS5V7	DAS5V7
LM54	DAS5V7	DAS5V8
LM83	DAS5V7	DAS5V8
LM95	DAS5V14	DAS5V12
LM56	DAS5V14	DAS5V12
LM57	DAS5V12	DAS5V12
LM91	DAS5V11	DAS5V16
LM205	DAS5V11	DAS5V16
LM240	DAS5V11	DAS5V16
LM213	DAS5V16	DAS5V16
LM218	DAS5V16	DAS5V16
LM237	DAS5V16	DAS5V16

for FLUORESCENT BACKLIGHT		
MODEL NUMBER	+ 12VDC INPUT	+ 24VDC INPUT
LM656	DAS12F06	DAS24F02
LM650	DAS12F06	DAS24F02
LM645	DAS12F06	DAS24F02
LM678	DAS12F06	DAS24F02
LM638	DAS12F06	DAS24F02
LM643	DAS12F06	DAS24F02
LM674	DAS12F06	DAS24F02
LM879	DAS12F06	DAS24F02
LM853	DAS12F06	DAS24F02
LM858	DAS12F06	DAS24F02
LM875	DAS12F06	DAS24F02

NOTE: Never apply power without load on inverter output.
Catastrophic failure may result.

■ DAS5V7

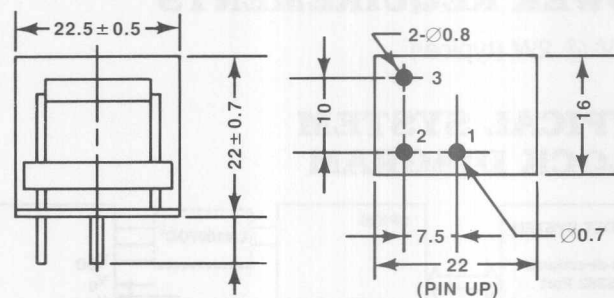
ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Input Voltage	V_{IN}	0	6	V
Temperature-Operating	T_{op}	-10	+60	°C
Temperature-Storage	T_{stg}	-20	70	°C

ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}	2.5	5.0	5.5	V
Input Current	I_{IN}	—	110	—	mA
Output Voltage	V_{OUT}	—	67	—	Vrms
Output Frequency	f_{OSC}	—	430	—	Hz

DIMENSIONAL DRAWING



	Signal
1	DC5V INPUT
2	COMMON
3	OUTPUT

■ DAS5V8

ABSOLUTE MAXIMUM RATING

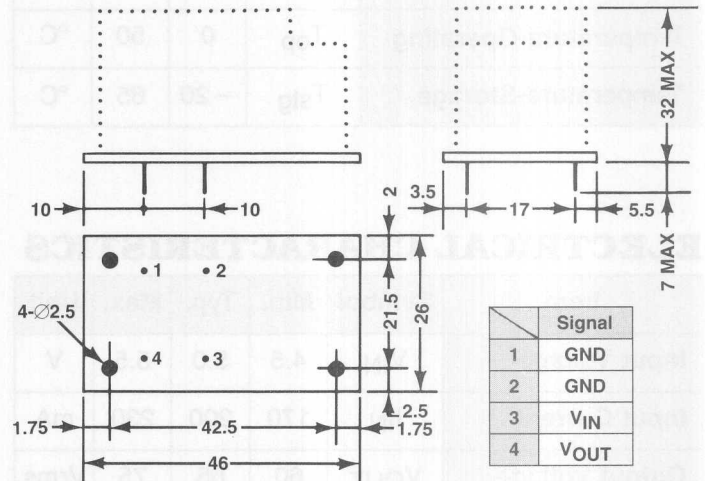
Item	Symbol	Min.	Max.	Unit
Input Voltage	V_{IN}	0	6.0	V
Temperature-Operating	T_{op}	0	50	°C
Temperature-Storage	T_{stg}	-20	65	°C

ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}	4.5	5.0	5.5	V
Input Current	I_{IN}	50	60	80	mA
Output Voltage	V_{OUT}	60	75	90	V _{rms}
Output Frequency	f_{OSC}	700	750	800	Hz

Load = $0.2\mu F/50k\Omega$

DIMENSIONAL DRAWING



■ DAS5V11

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Input Voltage	V_{IN}	0	5.5	V
Temperature-Operating	T_{op}	0	50	°C
Temperature-Storage	T_{stg}	-20	70	°C

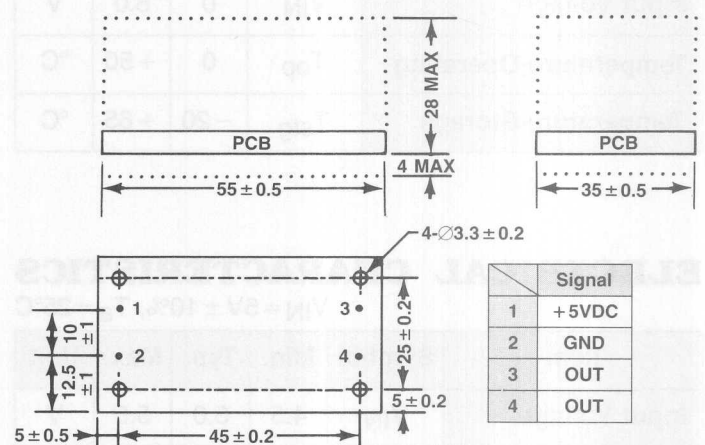
ELECTRICAL CHARACTERISTICS

$V_{IN} = 5V \pm 10\%$, $T_a = 25^\circ C$

Item	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}	4.5	5.0	5.5	V
Input Current	I_{IN}	—	420	—	mA
Output Voltage	V_{OUT}	—	85	—	V _{rms}
Output Frequency	f_{OSC}	—	480	—	Hz

Load = $370cm^2$ EL Lamp

DIMENSIONAL DRAWING



All dimensions are in millimeters.

■DAS5V12

ABSOLUTE MAXIMUM RATING

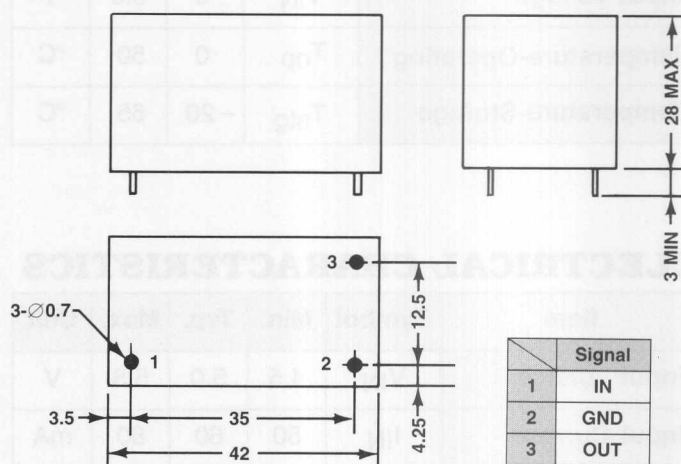
Item	Symbol	Min.	Max.	Unit
Input Voltage	V_{IN}	0	6.0	V
Temperature-Operating	T_{op}	0	50	°C
Temperature-Storage	T_{stg}	-20	65	°C

ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}	4.5	5.0	5.5	V
Input Current	I_{IN}	170	200	230	mA
Output Voltage	V_{OUT}	60	65	75	Vrms
Output Frequency	f_{OSC}	400	450	500	Hz

LOAD: 250cm² EL lamp

DIMENSIONAL DRAWING



■DAS5V13

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Input Voltage	V_{IN}	0	6.0	V
Temperature-Operating	T_{op}	0	+50	°C
Temperature-Storage	T_{stg}	-20	+65	°C

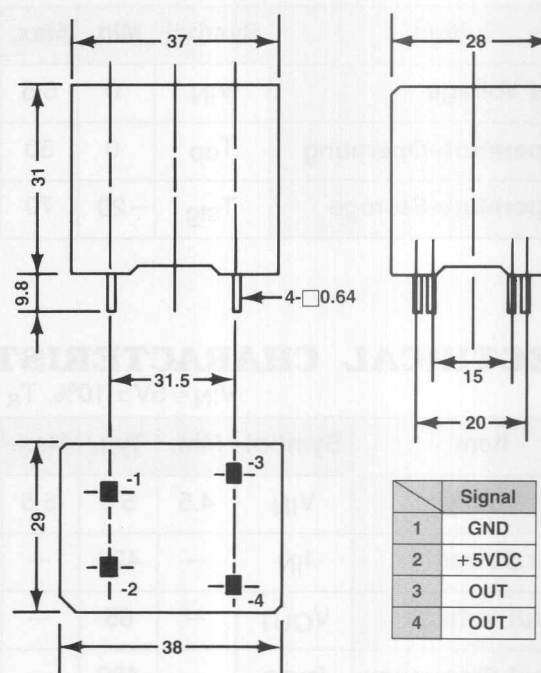
ELECTRICAL CHARACTERISTICS

$V_{IN} = 5V \pm 10\%$, $T_a = 25^\circ\text{C}$

Item	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}	4.5	5.0	5.5	V
Input Current	I_{IN}	270	300	330	mA
Output Voltage	V_{OUT}	102	110	118	Vrms
Output Frequency	f_{OSC}	390	400	410	Hz

LOAD: 250cm² EL lamp

DIMENSIONAL DRAWING



■ DAS5V14

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Input Voltage	V_{IN}	0	6.0	V
Temperature-Operating	T_{op}	-10	55	°C
Temperature-Storage	T_{stg}	-20	70	°C

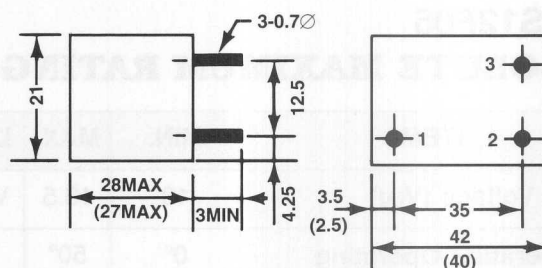
ELECTRICAL CHARACTERISTICS

$V_{IN} = 5V \pm 10\%$, $T_a = 25^\circ C$

Item	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}	4.5	5.0	5.5	V
Input Current	I_{IN}	120	140	160	mA
Output Voltage	V_{OUT}	65	70	75	Vrms
Output Frequency	f_{OSC}	490	492	494	Hz

LOAD = 100cm² EL lamp

DIMENSIONAL DRAWING



	Signal
1	IN
2	GND
3	OUT

■ DAS5V16

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Input Voltage	V_{IN}	0	6.0	V
Temperature-Operating	T_{op}	0	50	°C
Temperature-Storage	T_{stg}	-20	65	°C

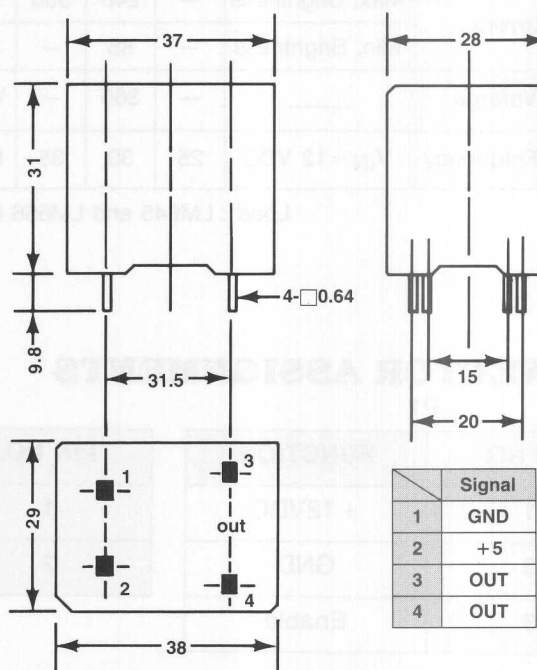
ELECTRICAL CHARACTERISTICS

$V_{IN} = 5V \pm 10\%$, $T_a = 25^\circ C$

Item	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}	4.5	5.0	5.5	V
Input Current	I_{IN}	430	480	530	mA
Output Voltage	V_{OUT}	102	110	118	Vrms
Output Frequency	f_{OSC}	400	420	440	Hz

LOAD = 200cm² EL lamp

DIMENSIONAL DRAWING



	Signal
1	GND
2	+5
3	OUT
4	OUT

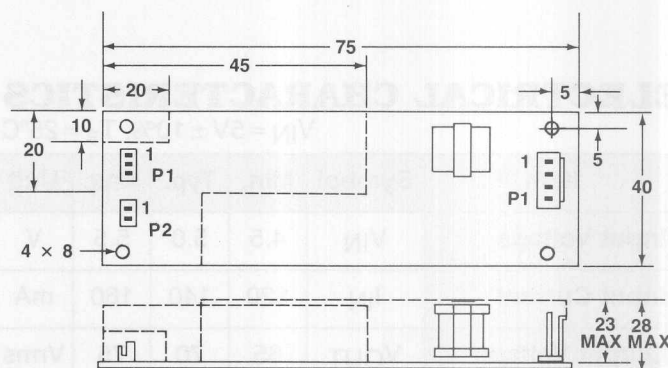
INVERTERS FOR COLD CATHODE FLUORESCENT BACKLIGHT

■ DAS12F06

ABSOLUTE MAXIMUM RATING

ITEM	MIN.	MAX.	UNIT
Input Voltage (V_{IN})	10	13.5	VDC
Temperature-Operating	0°	50°	°C
Temperature-Storage	-10°	65°	°C

DIMENSIONAL DRAWING

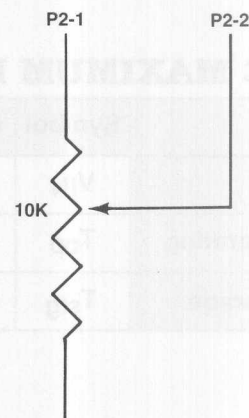


ELECTRICAL CHARACTERISTICS

ITEM	CONDITION	MIN.	TYP.	MAX.	UNIT
Input Voltage	—	11.4	12.0	12.6	VDC
Input Current	Max. Brightness	—	240	300	mA
	Min. Brightness	—	85	—	mA
Output Voltage	—	—	360	—	Vp-p
Output Frequency	$V_{IN} = 12$ VDC	25	30	35	KHz

Load : LM645 and LM656 lamp

EXTERNAL CONTROL FOR VARIABLE BRIGHTNESS



CONNECTOR ASSIGNMENTS

P1

PIN NO.	FUNCTION
1	+12VDC
2	GND
3	Enable

P2

PIN NO.	FUNCTION
1	V_R IN
2	V_R IN

P3

PIN NO.	FUNCTION
1	Output
2	N/C
3	N/C
4	Output

Enable Function

0 (GND) = Lamp ON
1 (V_{IN} or OPEN) = Lamp OFF

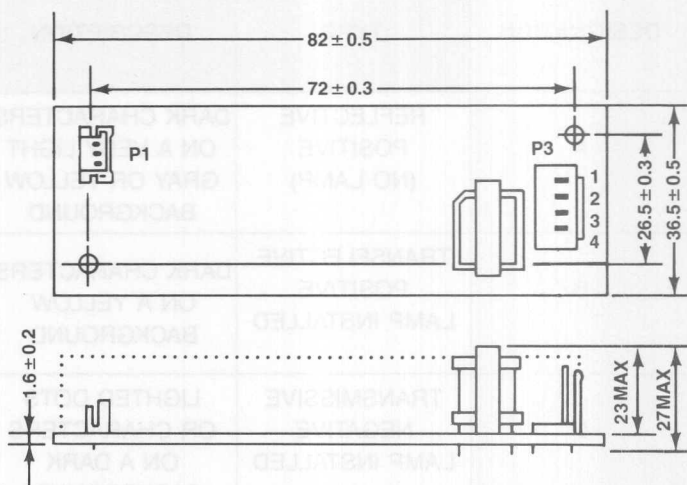
All dimensions are in millimeters.

■ DAS24F02

ABSOLUTE MAXIMUM RATING

ITEM	SYMBOL	MIN.	MAX.	UNIT
Input Voltage	V_{IN}	21	27	V
Temperature-Operating	T_{op}	0	50	°C
Temperature-Storage	T_{stg}	-10	65	°C

DIMENSIONAL DRAWING



ELECTRICAL CHARACTERISTICS

$T_a = 25^\circ\text{C}$

ITEM	SYM.	CONDITION	MIN.	TYP.	MAX.	UNIT
Input Voltage	V_{IN}	—	21.6	24	26.4	V
Input Current	I_{IN}	$V_{IN} = 24\text{V}$	90	100	120	mA
Output Voltage	V_{OUT}	$V_{IN} = 24\text{V}$	200	300	400	Vp-p
Output Frequency	f_{OSC}	$V_{IN} = 24\text{V}$	25	30	35	KHz

Load : LM645 and LM656 lamp

P1		P3	
Pin No.	Function	Pin No.	Function
1	+24VDC	1	OUTPUT
2	GND	2	N/C
3	Enable	3	N/C
		4	OUTPUT

Enable Function
 0 (GND) = Lamp ON
 1 (V_{IN} or OPEN) = Lamp OFF

MATING CONNECTORS FOR DAS12F06 AND DAS24F02

	MATING SHELL	CRIMP PINS
P1	EHR-3	SEH-001T-P0.6
P2*	PHR-2	SPH-002T-P0.5
P3	VHR-4N	SVH21T-1.1

*DAS12F06 only

Recommended connector source: JST Company

DESCRIPTION OF POLARIZER TYPE

DESIGNATION	TYPE	DESCRIPTION	AMBIENT LIGHT CONDITIONS			
			DIRECT SUNLIGHT	OFFICE LIGHT	SUBDUED LIGHT	VERY LOW LIGHT
A	REFLECTIVE POSITIVE (NO LAMP)	DARK CHARACTERS ON A VERY LIGHT GRAY OR YELLOW BACKGROUND	EXCELLENT	VERY GOOD	POOR	UNUSABLE
B	TRANSFLECTIVE POSITIVE LAMP INSTALLED	DARK CHARACTERS ON A YELLOW BACKGROUND	EXCELLENT (LAMP OFF)	VERY GOOD (LAMP OFF)	VERY GOOD (LAMP ON)	VERY GOOD (LAMP ON)
E	TRANSMISSIVE NEGATIVE LAMP INSTALLED	LIGHTED DOTS OR CHARACTERS ON A DARK BACKGROUND*	FAIR-GOOD* (LAMP ON)	GOOD (LAMP ON)	VERY GOOD (LAMP ON)	EXCELLENT (LAMP ON)
F	TRANSMISSIVE POSITIVE LAMP INSTALLED	DARK CHARACTERS ON A LIGHT OR LIGHTED YELLOW BACKGROUND	GOOD (LAMP OFF)	VERY GOOD (LAMP ON)	EXCELLENT (LAMP ON)	EXCELLENT (LAMP ON)
G	REFLECTIVE NEGATIVE (NO LAMP)	LIGHT DOTS ON A DARK BACKGROUND*	VERY GOOD	GOOD	POOR	UNUSABLE

*Data can be inverted improving readability in high ambient light.

The data in this catalog is designed to guide the engineer in selecting a display. The purchaser is responsible for the determination of the suitability of these products in their intended application. Due to the wide variety of applications, performance under any particular conditions is based upon purchaser's independent

conclusions and no conclusion, representation or warranty is made nor implied as to the suitability of these devices in any particular application and/or conditions beyond our control. Specifications subject to change without notice.

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